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A DESCRIPTION OF SOME PHILIPPINE THALASSEMÆ WITH A REVISION OF THE GENUS

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Two plates and 3 text figures

During a residence at the marine biological station of the University of the Philippines and the Bureau of Science at Port Galera, Mindoro, in 1912, I collected 3 species of *Thalassema.* One of these, *Thalassema sorbillans* Lampert, was described from the Philippines in 1883 and has not been recorded elsewhere. Another, *Thalassema semoni* Fischer, has been previously recorded from Amboina by Fischer, and from the Maldive Islands by Shipley, but has not before been found in the Philippines. The third species is new, and I have called it *Thalassema griffini* in honor of Dr. L. E. Griffin by whose aid and encouragement I have been able to complete this paper. Later in the year, Mr. A. L. Day, of this laboratory, on a trip of the Government cableship *Rizal,* obtained one specimen of a species which seems to be *T. formosulum* Lampert. A brief description of this specimen has been included.

Thalassema sorbillans Lampert.

Thalassema sorbillans LAMPERT, Zeitschr. f. wiss. Zool. (1883), **39,** 340; SHIPLEY, Willey's Zool. Results (1899), pt. 3, 352.

Numerous specimens of this species were collected from a sandy beach on Buquete Island, Port Galera. The sand was fine, containing much organic matter to a depth of about 15 cm.; at this depth it passed abruptly into a layer of coarse, clean gravel. *Thalassema sorbillans* was found in the top layer of sand, more than 100 specimens being collected in a space 1 meter square. I was able to keep a number of individuals alive in an aquarium for several days, but was so busy with other work that I did not have much time for observing them. They were able to burrow in the sand without any difficulty, and fed by taking up pellets of sand and passing them through the intestine.

The body of this species is from 3 to 5 cm. in length, and the proboscis is more than half as long as the body. Both the body and proboscis may be extended to about twice the usual length when the animal is feeding or moving about on the surface of the sand. The diameter of the largest specimens measures from 14 to 16 mm. The body is rather pointed at both ends, and 2 short curved setæ are borne from 5 to 10 mm. back of the mouth on the ventral surface. The body wall is so thin that the internal organs often may be seen through it. Small papillæ are scattered over all parts of the body, but are most numerous and prominent on the posterior region.

As in Lampert's specimens, there are 13 bundles of longitudinal muscles. Even in the largest specimens these are very small and thin, and in the smaller and younger individuals they cannot be detected by means of the microscope.

Cross sections were made of the central part of the body wall of 4 specimens ranging from the youngest to the oldest, in order to compare the dermal muscle layers. In the youngest specimen the longitudinal muscle is continuous and of very nearly uniform thickness. In the next individual there are 13 longitudinal swellings of the longitudinal muscle, although it remains continuous all the way around the body. In the third specimen the bundles have become thicker, while between the bundles the muscle has decreased considerably in thickness. In the fourth and oldest specimen the longitudinal bundles are comparatively thick, while the muscle between the bundles has become attenuated, as if it had been pulled out, until it has a thickness of only one row of fibers in some places, and in others it even has disappeared entirely. In all the sections the oblique muscle layer is very thin, but it is continuous and uniform in thickness, and follows the outline of the longitudinal muscles. In the spaces in which that muscle is lacking, the oblique layer is separated from the circular layer only by connective tissue.

The color of the living worm is a rich brownish pink. The presence of the longitudinal muscles is indicated in the larger specimens by 13 white longitudinal lines. The proboscis is pale cream color on the dorsum; faint green lines run along the edges of the groove on the ventral side. In formalin both the body and proboscis become nearly colorless.

There are 3 pairs of unusually small nephridial sacs, of which the posterior pair is always the largest. In a specimen 7 cm. long the sacs measured, respectively, 2, 3, and 5 mm. in length. The anterior pair always lies in front of the ventral setæ, the second pair about an equal distance back of the setæ, and the second and third pairs are always about twice as far apart as the first and second. Each sac bears 2 spirally twisted nephridia which enter the sac by a common opening on the dorsum just within the attachment of the sac to the body wall.

The anal trees are long, brown in color, and open into the rectum on the left side. Lying between them is a small spherical diverticulum of the rectum (fig. 1). The anal trees are covered with short ciliated funnels which are plainly visible under a magnification of 50 diameters.

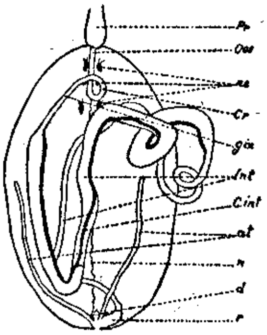

FIG. 1. Diagram of the internal organs of *Thalassema sorbillans* Lampert. *pr*, proboscis; *ne*, nephridial sacs; *oes*, œsophagus; *cr*, crop; *giz*, gizzard; *int*, intestine; *c. int*, collateral intestine; *r*, rectum; *d*, diverticulum; *at*, anal trees; *n*, nerve.

The alimentary canal has a total length of about 36 cm. in the largest specimens. It may be divided into 5 parts—œsophagus, crop, gizzard, intestine, and rectum. This form differs from the majority of echiuroids in that there is no muscular pharynx, the mouth opening directly into the thin-walled œsophagus, which is a straight tube about 1 cm. long. The "heart" is attached to its dorsal surface, and the two connecting blood vessels pass around it. Behind the "heart," the crop forms a loop, which when straightened out is about 1 cm. long. From it the gizzard, or "midgut," runs transversely to the left. This organ has a length of about 2 cm., and is smaller in diameter than the crop. At the end of the gizzard the canal widens greatly, the walls become much thinner, and the intestine may be said to begin at this point. The intestine is divided into two parts. The first part has a diameter of from 4 to 5 mm., a length of about 15 cm., and bears the collateral intestine throughout its length. The latter organ is about 1 mm. in diameter, and its walls are thicker than those of the main part of the intestine. Both of its openings into the intestine may easily be found. The second part of the intestine, which begins at the end of the collateral intestine, is a little longer than the first part, but is much smaller in diameter. The course of the intestine is rather complex, but seems to be nearly constant in the specimens I have examined. From the gizzard it runs posteriorly on the left side almost to the rectum. Then it turns to the right, and extends forward to a point about even with the posterior surface of the crop. Here it turns ventrad, and passing under the other parts runs posteriorly until it reaches the left side of the rectum again. Turning to the right it forms an S-shaped loop and enters the rectum from the right. The rectum is less than a centimeter long; its diameter is only a little greater than that of the intestine. In addition to the intestine, it receives the anal trees, and bears a small spherical rectal diverticulum.

The œsophagus is attached to the body wall for the first 5 mm. of its length by means of 2 sheets of muscular filaments which run laterally to the wall just back of the mouth. The remainder of the canal is held in place by means of thick muscular bands which extend latero-ventrad from its ventral surface to the body wall. These bands are very numerous along the upper part of the intestine, but decrease in number toward the posterior end. The rectum has a radial mesentery, and the diverticulum is attached by filaments to the sheath of the nerve cord.

In one specimen dissected a very remarkable variaton of the crop was noted (Plate I, fig. 1). In place of the simple loop, the walls of the tube had grown together in such a way as to form a heart-shaped sac which was partially divided into 2 chambers by the fusion of the adjoining walls of the tube. The œsophagus was slightly constricted where it entered the sac, and the gizzard was somewhat shorter than usual.

The vascular system of *Thalassema sorbillans* agrees very closely with that of other species of the genus which have been described in detail. The dorsal blood vessel enters the body cavity from the proboscis. It runs backward on top of the œsophagus until it reaches the posterior part where it is enlarged to form a sac-like "heart." Out of the posterior end of this "heart" run 2 vessels which pass around the œsophagus on opposite sides and join the ventral vessel. This vessel runs forward, and divides into 2 branches which enter the proboscis as the lateral vessels of that organ. The body cavity is filled with a clear fluid containing brownish red corpuscles. In the cœlomic fluid of all the specimens which were examined there were also great quantities of the "corpuscular bodies" which have been described by Ikeda (20).

The nervous system consists of a long ventral cord which runs from behind the mouth to the anus. At its anterior end it divides into 2 branches which run around the œsophagus and enter the proboscis. The cord bears no ganglia, but it gives off numerous small branches which supply the body walls.

Thalassema semoni Fischer.

> *Thalassema semoni* FISCHER, Zool. Forschungsr. in Australien, etc. Semon (1896), 5, pt. 3, 338; SHIPLEY, Willey's Zool. Results (1899), pt. 3, 351; Fauna and Geography of the Maldive and Laccadive Archipelagoes Echiuroidea (1902), 1, pt. 2, 129.

Two specimens of *Thalassema semoni* Fischer were collected on Buquete Island in holes in a sandstone rock along with many specimens of *T. griffini* (see page 249).

The body when extended was about 7 cm. long. The proboscis was about three-fourths that length, and was broad, flat, and slightly truncated. The proboscis broke from the body very easily, and did not leave a visible scar. Both of the specimens were perfect when they were found, but their probosces were broken off before they could be brought to the laboratory. The bodies of the preserved specimens are 4 cm. in length and 15 mm. in diameter; the probosces are greatly contracted. The body wall is rather tough, and is covered uniformly with papillæ. The two ventral hooks are present, but are very small and inconspicuous. The longitudinal muscle layer is continuous, showing no division into bundles.

Both the body and the proboscis were olive green when the animals were alive. In formalin they turned to dirty gray.

There are 2 pairs of nephridial sacs each bearing spirally twisted nephridia. The sacs are very long in proportion to the length of the body, the posterior pair in one specimen being longer than the body when straightened out. They are constricted at intervals, and contain partly developed eggs. The anterior pair opens in front of, and the second pair behind, the ventral hooks.

The anal trees are slender brown tubes about two-thirds as long as the body. They are covered with very small ciliated funnels.

The alimentary canal is about 34 cm. long. It is composed of 5 parts—pharynx, œsophagus, midgut, intestine, and rectum. The pharynx is about 5 mm. long and 2 mm. in diameter, and has thick muscular walls. It is held in position by means of 2 lateral mesenteries. The œsophagus is very much twisted, but has a length of about 2.5 cm. when it is removed and straightened out. Its walls are very much thinner than those of the pharynx. The next part of the canal, which I have called the midgut, is about 5 cm. long; it runs backward from the end of the œsophagus for about half its length, then turns on itself forming a U, and runs forward again where it turns to the right. The walls of this part are thicker than the œsophagus, but there is no indication of any separation into crop and gizzard such as is found in many other forms. The intestine as usual is composed of two parts. The first part, bearing the collateral intestine, is about 10 cm. long, and is much wider than any other part of the canal except the rectum. The second part is longer and narrower than the first part, and is filled with small regular pellets of sand. The rectum forms the last 15 mm. of the canal. It is a sac-like organ about 8 mm. in diameter, and bears the anal trees at its lower end.

The vascular and nervous systems agree in almost every respect with the typical forms of the genus.

Thalassema formosulum Lampert.

Thalassema formosulum LAMPERT, Zeitschr. f. wiss Zool. (1883), 39, 339; SHIPLEY, Willey's Zool. Results (1899), pt. 3, 340.

One individual of this species was collected by Mr. A. L. Day near Catbalogan, Samar. It was brought up on a cable from a depth between 10 and 24 fathoms. The bottom was of fine mud.

The length of the preserved specimen is 4.5 cm., and its greatest diameter is 18 mm. The proboscis is about 1 cm. long, and forms a tube at the mouth. The body is slightly pointed in front, while the posterior end is broad and flat with the anus opening on a small projection. The body wall is very thin, and is sparsely covered with small round white papillæ which are nowhere arranged in rings.

The longitudinal muscles show 7 narrow bundles, the spaces between the bundles being from two to three times as wide as the bundles. On sectioning, the dermal musculature was found to be unusually thick in proportion to the remainder of the body wall. The longitudinal muscle was found to be continuous, although it has the 7 thickenings which have been mentioned. The muscle of the bundle is between two and three times as thick as that of the region between the bundles. In all 3 layers the muscle has an unusual lack of compactness; the fibers, which are very large as compared with other forms, being scattered in a loose connective tissue which is full of small sinuses. The ventral setæ are long and hooked, with orange-colored tips. Internally, they are attached to the body wall by strong radial muscles, and their ends are connected by a powerful interbasal muscle.

In formalin the body is colorless, except the flattened posterior end, which is white.

There are 2 pairs of very small nephridia which open behind the ventral setæ. Owing to the smallness of the nephridia and the poor state of preservation of these organs, the character of the internal openings could not be determined.

The anal trees are about 2.5 cm. long and rather broad and sac-like. They are suspended from the body wall by muscular filaments. The structure of the funnels could not be distinguished. A spherical, rectal diverticulum is present.

The intestine was filled, except for the first 2 cm., with very small sausage-shaped pellets of mud.

Although this specimen is somewhat larger than *T. formosulum* as described by Lampert, the number and position of the nephridia, the arrangement of the longitudinal muscles, and the general external appearance of the specimen seem to justify identifying it as this species.

Thalassema griffini sp. nov.

Locality.—Port Galera, Mindoro. This species was first collected on the inner side of Buquete Island in a soft blue sandstone rock just above low-water mark. The rock was honeycombed with burrows made by a boring mollusk (*Gastrochæna?*), and the *Thalassema* was found in these old burrows along with *Gebia* and other crustaceans. In order to get them out, it was necessary to break up the rock with a crowbar. They were found in this place in considerable numbers during the entire time the station was occupied (March 12 to June 18). They were also collected in great numbers on the outer side of the island during most of the month of April. Here there is a small cove with a rock bottom into which numerous shallow potholes have been worn by wave action. These are partly filled with sand, gravel, and small stones. *Thalassema* was collected from the deeper holes. In one hole not over 60 cm. in diameter, 11 specimens were found and in another, 10, along with an equal number of sipunculids. They seemed to lie directly on the rocks with the sand and gravel covering them, and no definite burrows or openings could be observed on the surface. On the 1st of May they had entirely disappeared from this place, and could not be found there during the remainder of our stay at the station.

Size.—The bodies of the largest specimens reach a length of from 12 to 14 cm. when fully extended, with a diameter of from 10 to 12 mm. The proboscis varies in length from 5 to 8 cm.

If the animal be irritated, its body contracts to the shape and size of a large olive, and the proboscis is much shortened. I succeeded in killing specimens fairly well expanded by leaving them in sea water to which a little atropin was added from time to time.

The greatest thickness of the extended body is just back of the mouth, from which it tapers to a point at the posterior end. The two setæ are orange tipped, and are placed on the ventral surface near the mouth. The body wall is tough, and the longitudinal muscles are prominent. They are found in 17 or 18 bundles, the proportion of specimens having 18 bundles to those having 17 being nearly as 5 to 1. The surface of the body is covered with small papillæ which are especially prominent on the terminal regions, those of the posterior end being arranged in more or less definite rings.

Color.—In the living specimens the general color of the body is red, with broad white stripes running lengthwise. These correspond in number to the longitudinal muscles. The proboscis is bright green on the ventral side along the edge of the groove, and shades to a cream color on the dorsal surface. The tip is bright yellow, and the groove is pale yellow. When the circular muscles contract, the surface of the body is broken into deep red squares which appear and disappear as the peristaltic wave passes along the body.

Nephridia.—All of the specimens examined possess 3 pairs of nephridial sacs, the anterior pair always opening in front of the setæ. Each sac bears 2 spirally coiled internal openings. The sacs are always very much elongated, in some specimens the posterior sac being as long as the body; all contained eggs or spermatozoa when collected.

Anal trees.—These organs are clear transparent sacs, and are about one-half the length of the body. They are covered with microscopic, sessile, ciliated funnels.

THE BODY WALL

(FIGS. 3, 4, AND 5)

For the purpose of description it will be necessary to divide the body wall into three parts; namely, the anterior and posterior terminal regions and the middle portion. The anterior and posterior terminal regions are thickly covered with papillæ, and show no differentiation of the longitudinal muscle into bundles. In preserved specimens they extend for about 1 cm. from each end of the body. On the middle portion, the papillæ are smaller and scattered, and the longitudinal muscle is divided into 18 distinct bundles. The body wall is rather thick in both terminal regions, but becomes much thinner in the middle of the body.

As in other forms the wall is made up of a corium—consisting of the cuticle, epidermis, and dermis—the muscular layer, and the endothelium. The corium layer resembles the usual forms very closely. The cuticle is very thin and transparent. The epidermis consists of a layer of long cylindrical cells, the inner ends of which are produced into fine tapering processes such as are described by other writers. All over the surface and especially in the terminal regions, the epidermis is pushed out by thickenings of the dermis to form small papillæ. In the epidermal layer of these papillæ are found groups of long club-shaped cells which have a granular appearance and open on the surface by common pores in the cuticle. The dermis consists of a clear ground substance containing numerous long anastomosing fibers and very few cells, which gives it a more or less reticular appearance. Its thickness varies greatly in different places as it forms the main internal mass of the dermal papillæ. Inclosed in the dermis are found numerous large rounded bodies containing granules which stain deeply with hæmatoxylin. They do not appear to be connected with the surface, and no explanation of their function has occurred to me.

On taking up the study of the dermal muscle layer it was found to be so different from any other form that it seemed worthy of a rather detailed description. The description and drawings were nearly finished when a paper by Spengel(43) was received; Spengel describes specimens of *T. erythrogrammon,* in which the skin muscle layer is very much the same as in *T. griffini.* Spengel has compared 7 different specimens which have been described at various times as *T. erythrogrammon.* They are:

1. The original example of the species found by Rüppell in the Red Sea.
2. A specimen described by Lampert in 1883 as *T. caudex* and later referred to the species *T. erythrogrammon.*
3. An example in the Vienna Royal Museum, from Bourbon, identified and described by von Drasche in 1881.
4. Sluiter's specimen from the Island of Billiton, between Sumatra and Borneo, described in 1883.
5. A specimen collected by Willey in the China Straits near New Guinea and described by Shipley in 1899.
6. An example from the Bahamas described by C. B. Wilson in 1900 and a specimen from Florida in the possession of Spengel.
7. Specimens collected by Gardiner at the Maldive Islands and identified by Shipley in 1902.

Spengel has studied the dermal muscle layer of all of these forms, and on the basis of the difference in this structure he has divided the genus *Thalassema* into three separate groups, without regard to the number of longitudinal muscle bundles which they display. In the forms which have been described as having separate bundles of longitudinal muscle, he finds that "all have an uninterrupted, continuous layer of longitudinal muscle which is regularly thickened and intermittently thinned," thus giving the appearance of separate bundles except when examined very carefully under the microscope. He says also that in all forms the circular or ring muscle forms a continuous uniform sheet. Therefore, he separates his groups according to the degree in which this thickening and thinning of the longitudinal layer is found and the manner in which it occurs.

The first group for which he retains the generic name *Thalassema* and for which he takes the type species, *T. neptunii* Gaertner, as the type, has the following characteristics. The longitudinal muscle is of uniform thickness throughout, and the oblique muscle is also of uniform thickness and completely covers the longitudinal layer. The second group to which he gives the generic name *Listriolobus* is characterized as follows: The longitudinal muscle is thickened into bundles at intervals, and is not interrupted between the bundles, but simply becomes thinner, forming undulations. The oblique layer is like that of *Thalassema;* that is, of uniform thickness and completely covering the longitudinal layer. To this genus he assigns *T. erythrogrammon* of Sluiter and Wilson and the specimen which he has from Florida. To the third group he gives the old generic name of Rüppell—*Ochetostoma.* This group is characterized by having the main part of the longitudinal muscle interrupted by "intervals," so that longitudinal bundles are formed which appear to be separated, but are in reality connected by a very thin layer of longitudinal fibers between the bundles. The oblique muscle does not follow the longitudinal layer in the intervals, but bridges the intervals on septal bands of connective tissue. Also, the oblique muscle is not a continuous sheet as in the other forms, but is separated into bundles over the "intervals," so that these are connected with the cœlom by openings between these oblique bundles. In this genus he places the original *T. erythrogrammon* of Rüppell and Lambert's *T. caudex.* The position of the other specimens he does not define.

The dermal muscle layer of *T. griffini* bears a very close resemblance to that of *T. erythrogrammon* Rüppell, but there are some differences from the condition which Spengel describes and some points have been noted which he does not bring out in his description. In *T. griffini* the dermal-muscle layer consists of four parts. The first of these is a single layer of muscle cells lying at the base of the dermis, which runs in a longitudinal direction and covers the body throughout, completely separating the corium from the deeper muscle layers. This layer is so thin that it is very difficult to see in cross sections of the body wall, but it is easily found by peeling off the corium in glycerine and then examining with the microscope. On account of its position and relations to the surrounding parts, I have called it the external limiting muscle. Within the external limiting muscle are the three regular muscular layers—the circular or ring muscle, the longitudinal muscle, and the oblique muscle.

In order to make clear the relations between these muscles, it will be necessary to describe the middle or longitudinal layer first. In the two terminal regions which have been mentioned, the longitudinal muscle forms a thick continuous sheet without any separation whatever into bundles (fig. 5). At about 1 cm. from each end, this sheet gradually becomes separated into 18 large longitudinal bundles. In cross section these bundles have the shape of a more or less regular isosceles triangle with the base lying against the inner oblique layer and the apex turned outward. Between the bundles are the "intervals" of which Spengel speaks. He says that in Rüppell's specimen of *T. erythrogrammon* a very thin, but continuous, layer of longitudinal muscle continues across the intervals from the apex of one bundle to the next. In *Thalassema griffini* traces of this layer may be found, but in place of the continuous layer of which Spengel speaks it is broken up into small bundles of fibers and these bundles are scattered across the interval. These little bundles rarely consist of more than 10 muscle fibers, and they are in almost all cases separated by a space greater than the width of the bundles and in some cases the space between them may be as wide as half the whole interval. They are surrounded by connective-tissue fibers and overlaid by the endothelium (fig. 3).

The circular muscle on the outside of the longitudinal muscle is a continuous sheet in the terminal regions, about half the thickness of the longitudinal layer. In the middle region of the body the circular layer also changes in character. It becomes much thinner, and is spread out flat over the large longitudinal bundles, but over the intervals between them it is drawn together more or less to form bundles which are connected by a very thin layer of fibers.

The oblique or diagonal muscle on the inner side of the longitudinal layer is also continuous over the terminal regions although somewhat irregular in thickness, and it follows closely the outline of the longitudinal layer. In the middle region its condition is exactly like that described by Spengel; that is, between the longitudinal bundles, the oblique fibers are gathered into compact cords which bridge the intervals (fig. 2). On reaching the edges of the longitudinal bundles, the oblique fibers spread out fanwise, so that the middle of the longitudinal bundle is covered by a complete, but thin, layer of oblique fibers. The oblique fibers do not pass freely across the intervals, but lie on the inner edge of extremely thin connective-tissue septa which rise from the outer side of the interval (fig. 4) which, as Spengel says, are like dams across the interval, separating it into a great number of small 4-sided compartments opening into the cœlom between the oblique bundles. These "septal bands" are, as Spengel says, composed of the cell-poor connective tissue of the muscle layer, but in my specimens the septal bands have been found to contain a few isolated muscle fibers.

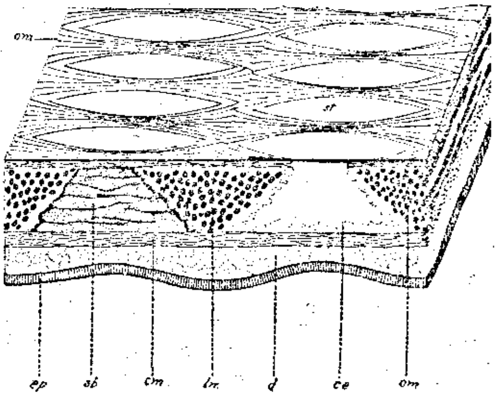

FIG. 2. Diagram of the body wall of *Thalassema griffini* sp. nov. *ep*, epidermis; *d*, dermis; *cm*, circular muscle; *lm*, longitudinal muscle in transverse section; *om*, oblique muscle; *sb*, septal band; *ce*, cœlomic epithelium; *st*, stomata in cœlomic surface.

The entire inner surface, including the intervals, the oblique muscles, and the bands, is covered by an endothelium composed of small, rounded, irregular cells. From this description it will be readily seen (1) that the body wall is divided into 18 longitudinal intermuscular spaces; that is, "intervals," by the 18 longitudinal bundles; and (2) that these intervals are again divided transversely into rows of narrow compartments, "stomata," by the septal bands and oblique bundles. As each one of these "stomata" is connected with the cœlom, they are, of course, filled with the cœlomic fluid, and as Spengel points out the contraction of the muscles would account for the small square "Buckeln der Haut" which are so characteristic of the living animal.

As to the function of these stomata, when we consider that they are covered only by the corium and a very thin layer of circular muscle, it seems very reasonable to assume that they are more or less closely associated with the respiration of the animal.

The importance of the dermal muscle layer, as a means of classification, will be discussed later.

THE ALIMENTARY CANAL

The alimentary canal is about four times as long as the body. For the first fourth, its course is definite, but the remainder seems to vary a little in different individuals. As in most worms the differentiation of the various parts of the canal is so slight that it has been very difficult to assign definite names and functions to them. This form does not seem to agree with any of the published descriptions which are at hand. The part of the canal from the mouth to the beginning of the intestine has been described differently in almost every species. Reitsch calls it simply "intestine buccal;" Spengel divides it into pharynx, œsophagus, and crop; Jameson speaks of the pharynx, œsophagus, gizzard, and crop of *T. neptunii;* Embleton divides this region of *Echiurus unicinctus* into pharynx, crop, and gizzard; and Ikeda describes a pharynx, œsophagus, crop, and midgut in *T. tænoides.* Moreover, this difference is not simply a difference in names but in the structure of the parts themselves. For example, in *Echiurus unicinctus,* the gizzard, which has very thick walls of circular muscle, reduced epithelium, and no glands, corresponds in position to the midgut of *T. tænoides* in which the epithelium is folded and glandular and in which thin layers of both longitudinal and circular muscles are present.

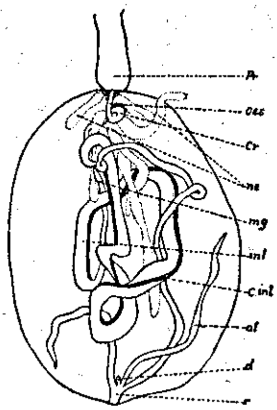

FIG. 3. Diagram of the internal organs of *Thalassema griffini* sp. nov. *pr,* proboscis; *ne,* nephridial sacs; *oes,* œsophagus; *cr,* crop; *mg,* midgut; *int,* intestine; *c. int,* collateral intestine; *r,* rectum; *d,* diverticulum; *at,* anal trees.

In *T. griffini* three distinct regions can be made out in this part of the alimentary canal. These may be called œsophagus, crop, and midgut for want of better terms to describe them. They are followed by the intestine and rectum. The œsophagus is a straight tube about 1 to 2 cm. long and 2 mm. in diameter. The epithelium is ciliated, and is slightly folded. The muscle layer is rather thicker at the anterior end than in any other part, but the difference is not great enough to justify speaking of it as a pharynx. The upper part is held in position by means of a mesentery radiating to the body wall. At the posterior end, the dorsal surface is covered by the "heart," and the two "connecting vessels" pass around it on opposite sides. The crop is about 1 cm. long and from 2 to 3 mm. in diameter. It forms a loop at the end of the œsophagus and turns to the left. It is the thickest part of the canal, the thickness being due, not to muscles, but to the large villus-like folds of the epithelium. The remainder of the canal in front of the intestine is the midgut. It passes posteriorly from the crop almost to the end of the body and forms a U, turning again anteriorly. Here it widens into the intestine. The midgut has a little larger diameter than the crop, but the walls are very thin, and the folds of the epithelium are much reduced. The beginning of the intestine is marked by the opening of the collateral intestine, the siphonal groove not extending beyond it. The intestine can as usual be divided into 2 parts, the first part in this species being much shorter than the second, which begins at the end of the collateral intestine and extends to the rectum. It bears a siphonal groove all the way to the rectum. The first part is the widest region of the alimentary canal, having a diameter of about 4 mm., while the second part is considerably smaller. The walls of both are very thin. The rectum is short, and into it on the left side open the 2 anal trees. A small spherical diverticulum lies between them, and is attached by muscular filaments to the sheath of the nerve cord.

The œsophagus, crop, and intestine are held in place by means of thick muscular filaments attached to their ventral surface. The midgut is not attached to the body wall. A radiating mesentery connects the rectum to the posterior part of the body wall.

Microscopic structure.—The wall of the œsophagus (fig. 6) is composed of three layers—the epithelium, the muscle and connective-tissue layer, and the cœlomic endothelium. The epithelium consists of a layer of very long, slender, ciliated cells with small nuclei at their bases. Lying between the ordinary cells and opening on the surface are a great many long club-shaped gland cells containing a granular material which is more or less vacuolated. The submucous layer consists of a connective tissue in which the muscle fibers are held. It varies in thickness on account of the folding of the epithelium. The connective-tissue cells are small with large nuclei and very long fibrous outgrowths. In the inner part of this layer, muscle fibers of various kinds are regularly scattered, becoming more compactly arranged toward the outer surface. In the upper part of the œsophagus, from which the figure is taken, the muscle is moderately thick, but it gradually becomes thinner and less compact toward the posterior end. The endothelium consists of irregular, rounded cells which are very indefinite and indistinct, and seem to lie in a matrix of some kind. The basement membrane is distinct.

The structure of the crop (fig. 7) differs considerably from that of the œsophagus. The folds of the mucous membrane increase so greatly that the surface seems to be covered with villi. The epithelium is of the pseudo-stratified columnar type, ciliated in the anterior part. The nuclei of the cells present a very peculiar arrangement of the chromatin. In the newly formed cells lying near the base of the epithelial layer, the chromatin is in the form of many small discrete granules which do not appear to be connected by any chromatin network. As the cells approach the surface of the epithelium, the number of these granules decreases. Finally, near the surface the nuclei of some cells are clear and apparently altogether lacking in chromatin. Small droplets of mucin appear in a fairly regular row just below the inner surface of the epithelium. The main part of the villi consists of connective tissue. In the outer part of the submucous layer is a thin layer of circular muscles, and on the outside of this, particularly toward the posterior end, is a thin layer of longitudinal fibers. The endothelium is more regular than that of the œsophagus.

The walls of the midgut are much thinner than those of either the œsophagus or crop. The projections of the mucous membrane are in the form of low, parallel ridges running longitudinally, with a thin layer of epithelium and a very loose connective-tissue layer. Here we have a definite sheet of longitudinal muscle fibers on the inside, but this has a thickness of only 2 or 3 fibers, and outside of it is a thin layer of circular muscles. In both the crop and the midgut the circular muscles are scattered loosely in the connective tissue.

The walls of the first part of the intestine are very thin, but have much the same general structure as the midgut. The submucous layer is very loose, so that in some places there seem to be sinuses. The collateral intestine has thicker walls, but they seem to be of the same general arrangement as the main part of the intestine. The second part of the intestine has the siphonal groove running its entire length to the rectum.

Vascular and nervous systems.—These two systems of organs do not require description as they agree very closely with the ordinary forms.

Reproductive system.—In all the specimens which were dissected, the nephridial sacs were full of spermatozoa or well-developed eggs; also, in the stomata of the body wall numbers of unripe eggs were often encountered, but although sections were studied from almost every part of the body, including the sheath of the nerve cord, the blood vessels, the body walls, and the nephridial sacs, no traces of reproductive tissue of any kind were discovered. Therefore, it seems probable that the formation of ova or spermatozoa must be limited to definite seasons. From the finding of the partially developed eggs in the stomata, it would seem probable that they are developed from the body wall.

A REVISION OF THE GENUS THALASSEMA

Since the publication of Shipley's paper on the revision of the Echiuroidea in 1899, in which there is given a key to the genus *Thalassema* and a brief outline of the characters of the then known species, there has been no attempt to revise the genus as a whole. In the meantime, the number of known species assigned to this genus has increased from 22 to 35. Also, a number of the species mentioned by him have been obtained in new localities, and in some cases important details have been added to the descriptions.

Shipley bases his classification, first, on the condition of the longitudinal muscles of the dermal muscle layer and, secondly, on the number of pairs of nephridia. In 1912, Spengel(43) provisionally divides the group into 3 genera on the basis of the microscopic structure of the dermal muscle layer, without regard to the number or arrangement of the nephridia. The characteristics of these 3 genera have been stated already (page 252). In regard to the first two genera, *Thalassema* and *Listriolobus*, the comparison of the muscle layers of *T. sorbillans* at different stages (page 244) seems to indicate that these two are too closely related to be separated into distinct genera; the condition found in the *Listriolobus* type—a thickening and thinning of the muscular layer—seems to be brought about, from the form in which the muscle is uniform in thickness, by a growth in the regions of the bundles and a consequent pulling apart and thinning of the interbundle region. In fact, in the 4 individuals of *T. sorbillans* which were examined, all the stages from one with a slight thickening but an almost continuous and uniform layer to a differentiation into distinct bundles may be seen. In *T. formosulum* a condition midway between the two extremes seems to exist. In the case of *T. griffini* and of *T. erythrogrammon* of Rüppell, if we study only that part of the dermal muscle layer in which the bundles are seen, it would seem to be entirely different from the other forms (figs. 3 and 4), and only a study of the development of the species would show how this differentiation has occurred. However, a glance at a section of the body wall taken in the anterior terminal region (fig. 5), in which the longitudinal muscle is continuous and uniform in thickness, will cast grave doubts on the essential difference of this characteristic also. From these facts it seems probable that with more material at hand it would be possible to arrange a series showing the gradual differentiation of the muscles from *T. neptunii* at one end to *T. griffini* at the other.

Therefore, it does not seem advisable to take the dermal muscle layer as the essential characteristic for a division of the group. The other character suggested and used by Shipley in his key to the species of *Thalassema;* that is, the number of pairs of nephridia, seems then to be the most important and essential ontogenetic character on which to base the larger divisions of the group, going back as it does in the ontogeny of the group to the disappearance of the segmentation. It seems probable that the most primitive type in the group is that in which 3 or more pairs of nephridia are present; the greater number of pairs, the more primitive the form. Undoubtedly, the simplest forms in that group are those which have a continuous and uniform longitudinal muscle layer. From this type the differentiation of the nephridia occurs in two directions. First, that in which more than 2 nephridia are developed in each segment; as, for example, in *T. elegans* Ikeda. Secondly, that in which the nephridia decrease in number to 2 pairs or 1 pair. As proof of this, a note on the variation of the nephridia in *T. neptunii* by Stewart(44) is of interest. He found, in dissecting some specimens of this species from Plymouth, 1 individual in which a third unpaired nephridium was present, on one side, midway between the first and second pairs. By taking careful measurements on this abnormal individual and a number of other normal specimens, he came to the conclusion that this abnormal nephridium represented a segment, lying between the 2 segments which regularly bear the nephridia, from which in normal individuals the original pair of nephridia has been lost.

From a study of the position of the nephridia of those forms having only 1 pair of nephridia, it seems probable that that pair represents the most anterior pair in those forms with 2 and 3 pairs and that in the differentiation from 3 pairs to 1, first, the middle pair disappears and then the posterior pair. Therefore, in this arrangement of the species of the group, it has been divided; first, according to the number of nephridia and, secondly, according to the arrangement of the muscles and other less essential characters.

In examining the various species of *Thalassema* which have been described, 1 species is found which varies from the *Thalassema* type in such essential characteristics that I propose to make it the type of a new genus, and possibly it ought to be made the type of a new family. This is the species described by Ikeda (20) as *T. tænoides*. Its most striking character is its enormous size, its total length being some 2 meters. On taking its internal structure into account, there are two very deep lying and essential differences from the *Thalassema* type. They are: first, the number and arrangement of the nephridia and, secondly, the position of the longitudinal muscle in the dermal muscle layer. In all other species of *Thalassema* the nephridia are always in pairs or paired groups, the greatest number of pairs recorded being 4, in *T. decameron* Lanchester; and of paired groups, 8, in *T. gogoshimense* Ikeda.

In this form there are an enormous number of nephridia which are not arranged in pairs, but are scattered irregularly on each side of the nerve cord. Ikeda says:

> They were never less than 200 in total number, and in certain individuals I have estimated this to be nearly 400. Moreover, unlike all other known Echiuroids, there is no indication of their segmental arrangement nor of their strictly paired disposition. On the contrary, they occur densely and irregularly crowded together in two longitudinal zones, one on each side of the ventral nerve cord, beginning in front just behind the ventral hooks and extending posteriorly to a length of 10 to 18 cm.

Also, there are no spirally twisted internal openings, but all the nephridia end in a terminal funnel.

In all the *Thalassema* where descriptions of the dermal muscle layer are given, the longitudinal muscle always is found lying between the circular and oblique layers. In this species Ikeda says that the muscle layers are as usual, but his figure of the body wall shows that the thick longitudinal layer lies directly under the corium and to the outside of both the circular and oblique layers.

On account of these characters, I propose to erect the genus *Ikeda* with the following characteristics:

Genus **IKEDA** novum

Nephridia, indefinite in number, not arranged in pairs, and provided with terminal funnels; longitudinal muscle of the dermal musculature lying on the outside of the circular and oblique layers. This genus at the present time includes only the type species, *Ikeda tænoides* (Ikeda).

On account of the scattered condition of the literature on *Thalassema*, it has seemed advisable to give as nearly as possible a complete bibliography of each species of *Thalassema*, and this has been added at the end of the key to the genera *Thalassema* and *Ikeda* which follows.

Key to the genera Thalassema and Ikeda.

a^1. Gephyrea in which the nephridia are arranged in pairs. The longitudinal muscle of the dermal muscle layer lies between the circular and oblique layers. No posterior ring of setæ.. Genus **Thalassema** Gaertner.
  b^1. Forms possessing 1 pair of nephridia.
    c^1. Longitudinal muscles continuous.
      d^1. Nephridia without spirally coiled internal openings.
        e^1. Proboscis about as long as the body and forming a tube just before it joins the body. Anal trees very short and transparent like glass.. **T. diaphanes** Sluiter.
        e^2. Proboscis small. Anal trees of moderate size with irregular branches .... **T. faex** Selenka.
        e^3. Proboscis less than half the length of body. Anal trees bear large funnels situated close together on long stalks. **T. owstoni** Ikeda.
        e^4. Proboscis about ½ length of body. Anal trees as long as body with few short, ciliated funnels........................ **T. fuscum** Ikeda.
        e^5. Proboscis trilobed at tip. Anal trees short and sac-like. **T. gigas** Max Müller.
        e^6. Proboscis short. Anal trees short, with funnels on short stalks. Anal trees attached to body by means of muscular filaments. **T. arcassonensis** Cuenót.
      d^2. Nephridia with spirally coiled internal openings.
        e^1. Proboscis bilobed. Anal trees branched with funnels at tips of branches .... **T. lankesteri** Herdman.
    c^2. Longitudinal muscles forming bundles which may or may not be separated.
      d^1. Nephridia with spirally coiled internal openings.
        e^1. 10–11 muscle bundles. Proboscis about ⅓ the length of body. **T. hupferi** Fischer.
  b^2. Forms possessing 2 pairs of nephridia.
    c^1. Longitudinal muscle continuous.
      d^1. Length of proboscis 3 to 4 times the length of body when expanded. **T. neptunii** Gaertner.

d^2. Proboscis ¾ as long as body. Anal trees thin and brown and over half as long as body........ **T. semoni Fischer.**

d^3. Proboscis short. Anal trees short........ **T. sabinum Lanchester.**

c^2. Longitudinal muscles forming bundles which may or may not be separated by "intervals."

d^1. 7–8 muscle bundles. Proboscis ⅓ as long as body. Anal trees broad and sac-like........ **T. formosulum Lampert.**

d^2. 8 muscle bundles. Proboscis several times as long as the body. **T. mellita Conn.**

d^3. 8–10 muscle bundles. Anal trees small........ **T. exilii Fr. Müller.**

d^4. 13 muscle bundles. Proboscis longer than body. Anal trees short with simple diverticula, each ending in a funnel. **T. pellucidum Fischer.**

d^5. 14 muscle bundles. Anal trees longer than half the body. Rectal diverticulum present........ **T. manjuyodense Ikeda.**

d^6. 17–19 muscle bundles. Proboscis shorter than body. Anal trees long with short branching outgrowths........ **T. baronii Greef.**

b^2. Forms possessing 3 pairs of nephridia. Always with spirally coiled internal openings.

c^1. Anterior pair of nephridia opening in front of ventral setæ.

d^1. Longitudinal muscles continuous.

e^1. Proboscis one-half as long as body. Anal trees long and brown with few small funnels........ **T. inanense Ikeda.**

e^2. Proboscis as long as body. Anal trees long and brown with microscopic funnels........ **T. moebii Greef.**

d^2. Longitudinal muscles forming bundles which may or may not be separated by "intervals." No interbasal muscle. Funnels of anal trees always sessile.

e^1. 13 muscle bundles. Proboscis over ½ as long as body. Anal trees long with microscopic funnels. Rectal diverticulum. **T. sorbillans Lampert.**

e^2. 14 muscle bundles. Proboscis shorter than body. Anal trees thin and brown. Rectal diverticulum. **T. erythrogrammon Max Müller.**

e^3. 15–16 muscle bundles. Anal trees ½ as long as body with prominent funnels........ **T. stuhlmanii Fischer.**

e^4. 15–17 muscle bundles.. Anal trees with numerous funnels. Rectal diverticulum........ **T. leptodermon Fischer.**

e^5. 16–18 muscle bundles. Proboscis ⅓ as long as body. Anal trees with long brown tubes........ **T. caudex Lampert.**

e^6. 17–18 muscle bundles. Proboscis short. Anal trees with well-marked funnels........ **T. kokotoniense Fischer.**

e^7. 17–18 muscle bundles. Proboscis ⅜ as long as body. Anal trees ¾ length of body with small funnels. Rectal diverticulum. **T. griffini sp. nov.**

c^2. All three pairs of nephridia open behind the ventral hooks. Longitudinal muscle continuous.

d^1. Proboscis absent (?). Anal trees thin, long, and brown. **T. vegrande Lampert.**

d^2. Proboscis short. Anal trees ½ the length of body with small funnels........ **T. mucosum Ikeda.**

b^4. Forms possessing more than 3 pairs of nephridia.
  c^1. 4 pairs of nephridia. Longitudinal muscle divided into 10 bundles. **T. decameron Lanchester.**
  c^2. Nephridia arranged in paired groups, each group containing a varying number of nephridia. Longitudinal muscle continuous.
    d^1. 7 paired groups with 1–3 nephridia in each group..........**T. elegans Ikeda.**
    d^2. Nephridia in female in 3 pairs. In male in 3 to 8 paired groups with 1–4 nephridia in each group............ **T. gogoshimense Ikeda.**
a^2. Gephyrea of unusually large size in which the nephridia are indefinite in number, not arranged in pairs, and are provided with terminal funnels. The longitudinal muscle of the dermal muscle layer lies on the outside of the circular layer............ Genus **Ikeda** Wharton nov.
  b^1. Body length 40 cm. Proboscis length 150 cm., nephridia 200–400 in number. Anal trees 6–7 cm. in length, fixed at the tip by a muscle, and covered with tubules bearing funnels.... **Ikeda tænoides** (Ikeda).

NOTE. *T. viridis* Verrill, *T. verrucosa* Studer, and *T. papillosum* (Delle Chiaje) have not been included in the key. The first two because of the indefiniteness of their descriptions, and the last because I have not seen the description.

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IKEDA Wharton, genus novum

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ILLUSTRATIONS

PLATE I

FIG. 1. Abnormal crop of *Thalassema sorbillans* Lampert. × 10. (Drawn by Santos.)

2. *Thalassema griffini* sp. nov. Natural size. (Drawn by Espinosa.)

3. Transverse section of the body wall of *Thalassema griffini* sp. nov. from the middle region. (Zeiss ocular 1, objective D, camera lucida outline, reduced ½.)

ep, epidermis.
ep. gl, epidermal glands.
d, dermis.
cm, circular muscle.
lmb, longitudinal muscle bundle.
lmf, interbundle longitudinal muscle fibers.
cm, oblique muscle.
st, stomata.
ce, cœlomic epithelium.

4. Longitudinal section of the body wall of *Thalassema griffini* sp. nov. through an interval in the middle region. (Zeiss ocular 1, objective D, camera lucida outline, reduced ½.)

ep, epidermis.
ep. gl, epidermal glands.
d, dermis.
dgl, dermal gland.
lmf, longitudinal muscle fibers.
cm, circular muscle.
omb, oblique muscle bundles.
sb, septal bands.
ce, cœlomic epithelium.
st, stomata.

PLATE II

FIG. 5. Transverse section of the body wall of *Thalassema griffini* sp. nov. through the anterior terminal region. (Zeiss ocular 1, objective D, camera lucida outline, reduced ½.)

ep, epidermis.
ep. gl, epidermal glands.
d, dermis.
dgl, dermal glands.
cm, circular muscle.
lm, longitudinal muscle.
om, oblique muscle.
ce, cœlomic epithelium.

6. Transverse section through the anterior part of the œsophagus of *Thalassema griffini* sp. nov. (Zeiss ocular 3, objective $\frac{1}{12}$, camera lucida outline, reduced ½.)

epth, epithelium.
gl, glands.
ml, muscle layer.
end, endothelium.

7. Transverse section through the crop of *Thalassema griffini* sp. nov. (Zeiss ocular 3, objective $\frac{1}{12}$, camera lucida outline, reduced ½.)

epth, epithelium.
ml, muscle layer.
md, mucous droplets.
end, endothelium.
ct, connective tissue with sinuses.

TEXT FIGURES

FIG. 1. Diagram of the internal organs of *Thalassema sorbillans* Lampert. *pr*, proboscis; *ne*, nephridial sacs; *oes*, œsophagus; *cr*, crop; *giz*, gizzard; *int*, intestine; *c. int*, collateral intestine; *r*, rectum; *d*, diverticulum; *at*, anal trees; *n*, nerve.

2. Diagram of the body wall of *Thalassema griffini* sp. nov. *ep*, epidermis; *d*, dermis; *cm*, circular muscle; *lm*, longitudinal muscle in transverse section; *om*, oblique muscle; *sb*, septal band; *ce*, cœlomic epithelium; *st*, stomata in cœlomic surface.

3. Diagram of the internal organs of *Thalassema griffini* sp. nov. *pr*, proboscis; *ne*, nephridial sacs; *œs*, œsophagus; *cr*, crop; *mg*, midgut; *int*, intestine; *c. int*, collateral intestine; *r*, rectum; *d*, diverticulum; *at*, anal trees.

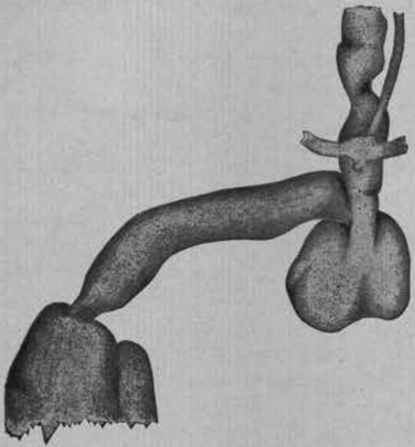

Fig. 1.

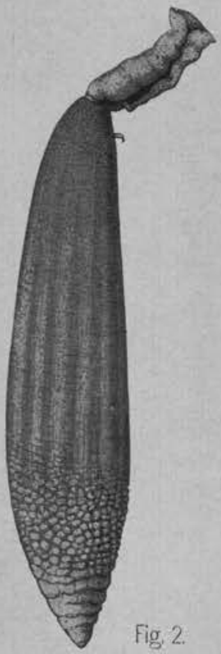

Fig. 2.

Fig. 1. Abnormal crop of Thalassema sorbillans Lampert.
2. Thalassema griffini sp. nov.

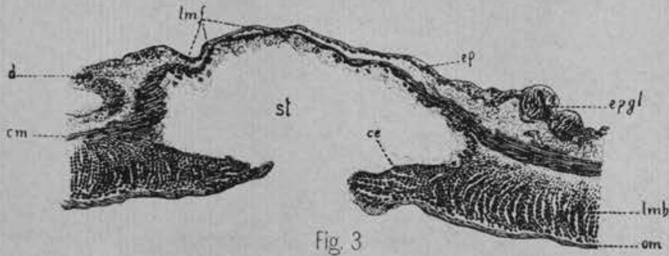

Fig. 3

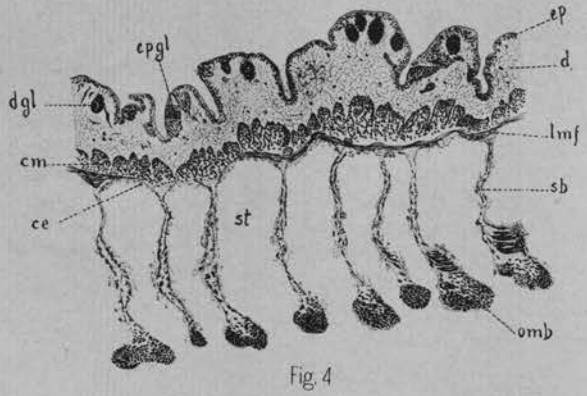

Fig. 4

Fig. 3. Thalassema griffini sp. nov. Transverse section of the body wall.
4. Thalassema griffini sp. nov. Longitudinal section of the body wall.

PLATE I.

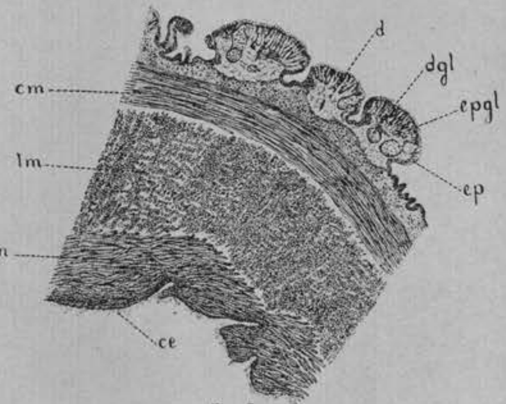

Fig. 5

Fig. 5. Transverse section of the body wall.

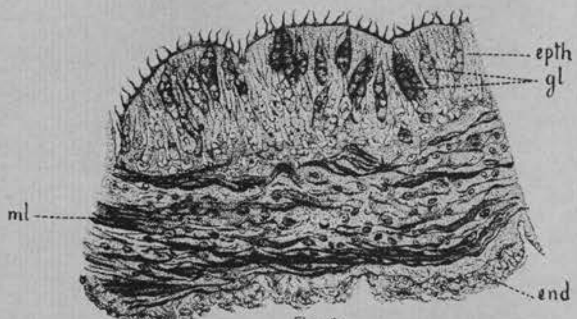

Fig. 6.

Fig. 6. Transverse section through the anterior part of the œsophagus.

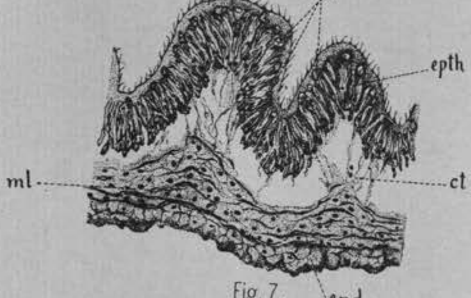

Fig. 7.

Fig. 7. Transverse section through the crop.

PLATE II. THALASSEMA GRIFFINI SP. NOV.

NOTES ON THE TERMITES OF JAPAN WITH DESCRIPTION OF ONE NEW SPECIES

By MASAMITSU OSHIMA
(Of the Institute of Science, Government of Formosa)

Two text figures

In his important paper, Die Termiten Japans,[1] Holmgren has given in all 12 species of termites from Japan and Formosa, of which one was referred to *Leucotermes speratus* (Kolbe) and another identified with *Coptotermes formosæ* described before by me, while the rest were considered by him to be new to science. In coming to that result, all the previous works of Japanese entomologists on the subject were left in complete disregard; how this came about is easy to perceive in as much as they all appeared in the language of the authors.

Now from a renewed examination of the termite material at my disposal and of the relevant literature known to me, it seems justifiable to make the following remarks: First, of the 12 termite species recorded by Holmgren, all except two, namely, *Hodotermopsis japonicus* Holmgren and *Leucotermes speratus* (Kolbe), were provided with scientific names in accordance with the rules of binomial nomenclature in use among systematists, and were described and figured in more or less detail by Japanese authors; so that in the cases of the 10 species indicated the specific names given by Holmgren should give way to the earliest proposed names, since, for all I can see, there is no reason to deny the application of the law of priority to the cases in question. Secondly, I shall add 3 more species to the termite fauna of Japan and outlying islands, raising the total number to 15. One of the forms added is a new species, *Calotermes ogasawaraensis*, from the Bonin Islands; the other two are species which were described by me before, *Calotermes inamurai* Oshima and *Leucotermes flaviceps* Oshima.

The classification adopted in the following list is that of Holmgren.[2] References to papers, reports, or periodicals published in Japanese are indicated with asterisks; a list giving their original titles will be found at the end of this paper.

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[1] *Annot. Zool. Jap.* (1912), 8.

[2] Termitenstudien (1912).

Order ISOPTERA

Family PROTERMITIDÆ Holmgren

Subfamily TERMOPSINÆ Holmgren

Genus HODOTERMOPSIS Holmgren

1. **Hodotermopsis japonicus** Holmgren.

Hodotermopsis japonicus HOLMGREN, Annot. Zool. Jap. (1912), 8, 112.

Locality.—Type specimens (*Watase* coll.) from Amami-Oshima, an island south of Kyushyu.

Subfamily CALOTERMITINÆ Holmgren

Genus CALOTERMES Hagen

2. **Calotermes** (subg. ?) **inamurai** Oshima.

Calotermes? inamurai OSHIMA, *Report Term. III (1912), 61; Pl. 1, figs. 5, 6, 21, 22; Pl. 2, figs. 2, 19.

Female.—Reddish brown above, paler below; head and pronotum glossy; head quadrangular, anterior border nearly straight, posterior border rounded; eyes large, round, and prominent; ocelli in contact with eyes; antennæ 19-jointed, twice as long as head; 2d and 3d joints subequal; labrum short, not covering tip of mandible; pronotum subreniform, with concave anterior border, posterior border nearly straight, slightly concave in the middle.

Measurement.	Mm.
Length of head	1.72
Width of head	1.56
Length of pronotum	1.19
Width of pronotum	1.84

Soldier (*larger form*).—Head cylindrical, reddish yellow; labrum, antennæ, and pronotum paler; mandibles 1.6 mm. long, blackish brown, toward basal portion reddish brown, outer margin arcuate, apex incurved; left mandible with 3 teeth, 2 apical teeth sharply pointed, the 3d tooth broad, with apex bifid; near bases of 2d and 3d teeth is a small tooth-like projection; right mandible with 2 strong triangular teeth; labrum very short, anterior margin arcuate, twice as broad as long; antennæ 15-jointed; basal joint cylindrical, narrower in the middle; 2d and 4th joints subequal, quadrilateral; 3d joint invertedly conical, anteriorly much enlarged; pronotum quadrilateral, broader than head; anterior border strongly concave; posterior border nearly straight, slightly concave in the middle; lateral margins arcuate; posterolateral corners broadly rounded; anterolateral angles quadrate; apex of tibia provided with 3 spines, of which two project downward and the other outward.

Measurement.	Mm.
Length of head with mandible	4.06
Length of head without mandible	2.91
Width of head	1.97
Length of body	9.50

Soldier (*smaller form*).—Agreeing with the larger form of soldier in all characters, but differing in dimensions of head and body.

Measurement.	Mm.
Length of head	2.25
Width of head	1.75
Length of body	7.00

Locality.—Kuraru, Formosa. Type specimens in the Institute of Science, Government of Formosa.

Remarks.—This species is named for Mr. T. Inamura, who collected the specimens. In the absence of winged specimens, subgeneric determination of the species cannot be made with certainty.

Subgenus **Neotermes** Holmgren

3. **Calotermes (Neotermes) koshunensis** Shiraki.

Calotermes koshunensis SHIRAKI, * Trans. Ent. Soc. Jap. (1909), **2**, 241; OSHIMA, * Report Term. I (1909), 29; * Zool. Mag. Tokyo (1910), **22**, 344; * Report Term. II (1911), 2; * The Insect World (1911), **15**, 361, Pl. 18, fig. 13; * Report Term. III (1912), 59, Pl. 1, figs. 1, 19, 20; Pl. 2, figs. 5, 8, 20, 25.

Calotermes koshunensis? NAWA, * The Insect World (1911), **15**, 94, Pl. 7.

Calotermes (*Neotermes*) *koshunensis* HOLMGREN, Annot. Zool. Jap. (1912), **8**, 114.

Localities.—Shiraki's types, which are preserved in the Agricultural Experiment Station, Government of Formosa, are from Kusukusu in southern Formosa. Outside of Formosa, specimens have been recorded by Nawa from the Loochoo Archipelago, and by Holmgren and Oshima from Botel Tobago Island (*Oshima* and *Hozawa* colls.; June, 1911).

Subgenus **Glyptotermes** Holmgren

4. **Calotermes (Glyptotermes) satsumensis** (Matsumura).

Termes sp. MATSUMURA, * Thousand Insects (1904), **1**, 24, fig. 9.

Termes satsumensis MATSUMURA, * Systematic Entomology (1907), **1**, 53, fig. 43.

Calotermes sp. SHIRAKI, Trans. Ent. Soc. Jap. (1909), **2**, 241.

Calotermes satsumensis YANO, * The Insect World (1910), **15**, 404; * Report Forestry Station Jap. (1911), No. 9, 64, Pl. 4, figs. 1–3; OSHIMA, * Report Term. III (1912), 63.
Glyptotermes longicephalus OSHIMA, * Report Term. III (1912), 64, Pl. 1, fig. 2, Pl. 2, figs. 6, 26.
Calotermes (Glyptotermes) satsumaensis HOLMGREN, Annot. Zool. Jap. (1912), **8**, 116.

Localities.—The types collected by Matsumura and preserved in the Agricultural College of Sapporo are from Satsuma. Another locality of the species is Tausha in Formosa (*Oshima* and *Hozawa* colls.; May, 1911).

5. **Calotermes (Glyptotermes) fuscus** Oshima.

Glyptotermes fuscus OSHIMA, * Report Term. III (1912), 67, Pl. 1, fig. 15.
Calotermes (Glyptotermes) hozawæ HOLMGREN, Annot. Zool. Jap. (1912), **8**, 118.

Localities.—Kuraru, southern Formosa (*Inamura* coll.), types in the Institute of Science, Government of Formosa. In 1911, Hozawa collected the species in the same place.

Subgenus **Cryptotermes** Banks

6. **Calotermes (Cryptotermes) kotoensis** Oshima.

Calotermes kotoensis OSHIMA, * Report Term. III (1912), 56, Pl. 2, figs. 3, 4, 17, 18; NAWA, * The Insect World (1912), **16**, 440.
Calotermes (Cryptotermes) formosæ HOLMGREN, Annot. Zool. Jap. (1912), **8**, 119.

Localities.—The types in the Institute of Science, Government of Formosa, are from Botel Tobago Island (*Oshima* coll.; June 14, 1911). Holmgren has recorded the species from the same locality (*Hozawa* coll.; June 14, 1911) and Nawa from the Loochoo Archipelago (*Iwasaki* coll.; Sept. 27, 1912).

7. **Calotermes (Cryptotermes) ogasawaraensis** sp. nov.

Male.—Light brown above, head and pronotum darker; paler below; legs, antennæ, and gula pale yellowish; head quadrangular, anterior border slightly rounded; eyes round and prominent; ocelli scarcely in contact with eyes; antennæ 14-jointed, longer than head; 2d joint slightly longer than 3d; pronotum subreniform, broader than head; anterior border slightly concave, posterior border arcuate; posterior border of mesonotum and metanotum straight, the latter half as long as the former; anterior wing-stumps much larger than, and entirely covering, the posterior ones; wings 6.5 mm. long, 2 mm. broad, transparent, silvery when dry; costal, subcostal, radius, and radius-sector dark brown; subcostal rudimentary; radius joining the costal on the basal fourth of wing; radiussector with 7 branches, the first one branches out from the point of basal fifth of wing; median and cubitus colorless, the former arcuate and joining the radiussector beyond the starting point of its fourth branch. The cubitus runs medially through the wing, and gives 11 branches to the posterior border.

Measurement.	Mm.
Length with wings	8.50
Length without wings	5.50
Length of head	1.12
Width of head	0.85
Length of pronotum	0.61
Width of pronotum	1.00

Soldier.—Pale yellow above, anterior half of head nearly black, posteriorly blackish purple; antennæ pale yellow; head quadrangular, truncated in front, and disposed at right angles to mandibles; posterior border rounded; antennæ 13-jointed, 2d joint cylindrical, twice as long as 3d; 4th joint ring shaped; below the antennal fossa is a strong spine, projecting anteriorly; mandibles subtriangular, with incurved tip, slightly curved upward in lateral view; cutting edge of left mandible with 2 small teeth near its apex and a strong basal tooth; that of right mandible with a broad tooth in the middle; rudimentary eye ovate and colorless; jugular sclerites very large, longer than half the length of head; pronotum semicircular, distinctly emarginate at middle of anterior border; mesonotum and metanotum together shorter than length of pronotum; hind legs not reaching to tip of abdomen.

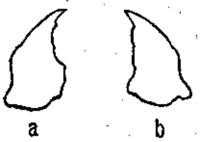

FIG. 1. *Coptotermes kotoensis* Oshima. Mandibles of soldier. *a*, left mandible; *b*, right mandible.

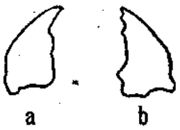

FIG. 2. *Coptotermes ogasawaraensis* sp. nov. Mandibles of soldier. *a*, right mandible; *b*, left mandible.

Measurement.	Mm.
Length of head with mandible	1.61
Length of head without mandible	1.39
Width of head	1.29
Length of pronotum	0.84
Width of pronotum	1.23

Locality.—Ogasawarajima or Bonin Islands, in the subtropical region of the Japanese Archipelago; collected by Mr. M. Ishida on August 23, 1912.

Remarks.—This species is closely allied to *C. kotoensis* Oshima. However, a close comparison of the two species shows several discrepancies. In the present species the antennæ of the imago are 14-jointed, the 2d joint being shorter than the 3d, while in *C. kotoensis* they are 16- or 17-jointed with the 2d joint longer than the 3d. Moreover, in the former the pronotum is much broader than the head instead of being narrower or subequal as in the latter. In the soldiers, the most notable difference lies in the dentition of the mandibles, as shown in the following figures; and, further, in *C. ogasawaraensis* the angle between forehead and mandibles is a right angle instead of being oblique as in *C. kotoensis.*

Family MESOTERMITIDÆ Holmgren

Subfamily COPTOTERMITINÆ Holmgren

Genus **COPTOTERMES** Wasmann

8. **Coptotermes formosanus** Shiraki.

Coptotermes formosanus SHIRAKI, * Trans. Ent. Soc. Jap. (1909), 2, 239; OSHIMA, * Report Term. I (1909), 33, Pl. 1, figs. 1, 2, 3, 11, 12; * Report Term. III (1912), 75, Pl. 1, figs. 1, 28, Pl. 2, figs. 3, 21.

Coptotermes gestroi OSHIMA, * Zool. Mag. Tokyo (1910), 22, 376; NAWA, * The Insect World (1910), 14, 597; OSHIMA, * Report Term. II (1911), 5.

Coptotermes formosæ HOLMGREN, Termitenleben auf Ceylon (1911), 192; Termitenstudien (1911), 2, 74; YANO, * Report Jap. Forestry Station (1911), No. 9, 62, Pl. 4, figs. 12–20; HOLMGREN, Annot. Zool. Jap. (1912), 8, 121.

Localities.—Shiraki's type was obtained in Taihoku, Formosa. This is one of the commonest species in Formosa, and has been recorded also from Japan proper, Shikoku, Kyushyu, Loochoo Archipelago, and Hachijojima.

Remarks.—*Coptotermes formosanus* is a species so very closely allied to *C. gestroi*, that Wasmann, the original describer of the latter, asserted, in a letter to Professor Watase, that the Formosan specimens represent true *C. gestroi;* however, they differ from this in the soldier having a narrower head.

Genus **ARRHINOTERMES** Wasmann

9. **Arrhinotermes japonicus** Holmgren.

Paratermes canalifrons OSHIMA, * Report Term. III (1912), 69, Pl. 1, figs. 13, 23, Pl. 2, figs. 9, 12.

Arrhinotermes japonicus HOLMGREN, Annot. Zool. Jap. (1912), 8, 122.

Localities.—Botel Tobago Island (*Oshima* and *Hozawa* colls.; June, 1911).

Remarks.—In 1912, I described this species under the name of *Paratermes* (n. g.) *canalifrons,* at the time believing it to be identical with Sjöstedt's *Termes* (*?*) *canalifrons,* for which I proposed the generic name above indicated. Now I see my mistake, and accept Holmgren's generic identification and the specific name given by him.

Subfamily LEUCOTERMITINÆ Holmgren

Genus **LEUCOTERMES** Silvestri

10. **Leucotermes speratus** (Kolbe).

Termes speratus KOLBE, Berl. ent. Zeitschr. (1885) 25, 145, Pl. 6; MATSUMURA, * Systematic Entomology (1907), 1, 54, fig. 44; OSHIMA, * Zool. Mag. Tokyo (1908), 20, 514.

Termes flavipes OSHIMA, * Zool. Mag. Tokyo (1909), 20, 515.

Leucotermes speratus SHIRAKI, * Trans. ent. Soc. Jap. (1909), 2, 230; OSHIMA, * Zool. Mag. Tokyo (1910), 22, 414; NAWA, * The Insect World (1910), 14, 547; YANO, * Report Jap. Forestry Station (1911), No. 9, 58, Pl. 4, figs. 4–11; OSHIMA, * Report Term. III (1912), 71, Pl. 1, fig. 11, Pl. 2, figs. 10, 13; HOLMGREN, * Annot. Zool. Jap. (1912), 8, 124.

Termes (Leucotermes) speratus OSHIMA, * The Insect World (1911), 15, 356, Pl. 18, figs. 4, 6.

Locality.—This species is the commonest termite in all parts of Japan proper.

11. **Leucotermes flaviceps** Oshima.

Leucotermes flaviceps OSHIMA, * Report Term. III (1912), 74, Pl. 1, fig. 10, Pl. 2, figs. 15–17.

Soldier.—Head pale yellow; mandibles reddish brown, basally paler; head cylindrical, flattened, posterior corner slightly rounded, anterior angles quadrate, lateral margins straight and parallel, ratio of length to width 1:0.60–0.62; mandibles saber shaped, with apex incurved, slender, and slightly curved upward in lateral view; cutting edge of left mandible with 3 small basal teeth; right mandible smooth; antennæ with 16 joints, the 3d joint narrowest and shorter than the 2d; labrum lanceolate, with whitish apex which is provided with 2 or 3 delicate hairs; pronotum narrower than head, lateral margins converging posteriorly, anterior angles acutely rounded, posterior angles broadly rounded; middle of anterior border emarginate, posterior border straight; abdominal papillæ present; body 4.5 mm. long.

Leucotermes flaviceps; measurements of head of soldier.

Locality.	Length.	Width.	Ratio of length to width.
Botel Tobago	1.56	0.97	1:0.62
Do	1.56	0.97	1:0.62
Do	1.75	1.06	1:0.61
Do	1.56	1.97	1:0.62
Do	1.72	1.03	1:0.60
Do	1.72	1.03	1:0.60
Horisha	1.72	1.06	1:0.62
Do	1.75	1.03	1:0.58
Do	1.75	1.03	1:0.58
Do	1.88	1.03	1:0.60

Worker.—Head pale yellow, antennæ 16-jointed, the 2d joint as long as the 3d and 4th taken together, the 4th ring shaped; pronotum as in soldier, decidedly narrower than head.

Localities.—Botel Tobago Island (*Oshima* coll.; June 18, 1911). Types in the Institute of Science, Government of Formosa. Taihoku, Horisha, Kankao, Formosa (*Oshima* coll.).

Remarks.—The head of the soldier is considerably narrower in *L. flaviceps* than in *L. speratus.* In my specimens of the former the ratio of head length to width is 1:0.60–0.62, while in the latter it is 1:0.62–0.70. Further, in the soldier of *flaviceps* the posterior border of the protonum is straight instead of being emarginate in the middle as in *speratus.*

A large number of *Leucotermes* collected by me in Taihoku, Horisha, and Kankao (Formosa) seem, as the result of comparisons, to be referable to the present species. This species is very closely related to *L. speratus,* and Holmgren and Yano have expressed the belief that the two should be united. Indeed, with the large series of the imago on hand, I have found it scarcely possible to draw a fast line between them. However, if we compare the soldiers, there exist some points of difference which seem to justify the separation of the two forms. Thus the soldier of the above-mentioned species has a head considerably narrower than that of *speratus,* and the middle of the posterior border of its pronotum is nearly straight instead of being clearly emarginated as in *speratus.*

Family METATERMITIDÆ Holmgren

Genus **ODONTOTERMES** Holmgren

Subgenus **Cyclotermes** Holmgren

12. **Odontotermes (Cyclotermes) formosana** (Shiraki).

Termes formosana SHIRAKI, * Trans. Ent. Soc. Jap. (1909) 2, 234; OSHIMA, * Report Term. III (1912), 81, Pl. 1, figs. 7, 26, 27, Pl. 2, figs. 11, 18.

Termes vulgaris SHIRAKI, * Trans. Ent. Soc. Jap. (1909), 2, 233; OSHIMA, * Report Term. I (1909), 37, figs. 9, 10; * Zool. Mag. Tokyo (1910), 22, 379; MATSUMURA, Die schädl. und nützl. Insecten v. Zuckerrohr Formosas (1910), 2, Pl. 1, figs. 2, 3, 4; SHIRAKI, * Special Report Agr. Exp. Station, Formosan Govt. (1910), No. 1, 1, Pl. 14, fig. 6; OSHIMA, * Report Term. II (1911), 7.

Termes vulgaris ? NAWA, * The Insect World (1911), 15, 281, Pl. 15.

Odontotermes formosanus HOLMGREN, Annot. Zool. Jap. (1912), 8, 127.

Odontotermes (Cyclotermes) formosanus HOLMGREN, Termitenstudien (1910), 3, 38.

Localities.—This is one of the commonest species in Formosa. Holmgren has recorded it from Hongkong (*Ransonet* coll.), Bangkok (*Ransonet* coll.), Canton, and Fotschau and Nawa from the Loochoo Archipelago (*Iwasaki* coll.). Recently I collected specimens at Amoy, China.

Remarks.—As this species agrees with *Termes vulgaris* Haviland in habits and in characters, except dimensions of body and wing, I, at one time, regarded it as identical with the latter. I now learn from Holmgren that the species is distinct from *T. vulgaris;* therefore, the specific name first given by Shiraki must stand.

Genus **CAPRITERMES** Wasmann

Subgenus **Capritermes** Holmgren

13. **Capritermes (Capritermes) nitobei** (Shiraki).

Eutermes nitobei SHIRAKI, * Trans. Ent. Soc. Jap. (1909), 2, 238; OSHIMA, * Report Term. I (1909), 40.

Eutermes longicornis OSHIMA, * Zool. Mag. Tokyo (1910), 22, 411; * Report Term. II (1911), 9; NAWA, * The Insect World (1912), 16, 18, Pl. 1, fig. 6.

Capritermes nitobei OSHIMA, * Report Term. III (1912), 82, Pl. 1, figs. 9, 14, Pl. 2, figs. 4, 5.

Capritermes sulcatus HOLMGREN, Annot. Zool. Jap. (1912), 8, 130.

Localities.—Type specimens preserved in the Institute of Science, Government of Formosa, are from Maruyama, Formosa. In addition to the types, I have collected specimens at Kuraru and Kusukusu, Formosa.

Genus **EUTERMES** Müller

Subgenus **Eutermes** s. str. Holmgren

14. **Eutermes (Eutermes) takasagoensis** Oshima.

Eutermes takasagoensis OSHIMA, * Report Term. III (1912), 86, Pl. 1, figs. 4, 12, Pl. 2, figs. 1, 23.

Eutermes (*Eutermes*) *piciceps* HOLMGREN, Annot. Zool. Jap. (1912), 8, 132.

Localities.—Kankao, Formosa (*Oshima* coll.; June 10, 1911), Botel Tobago Island (*Oshima* coll.; June 16, 1911). Recently Holmgren has recorded the species from Christmas Island and Nawa from Ishigakijima, Loochoo Archipelago.

15. **Eutermes (Eutermes) parvonasutus** Oshima.

Eutermes parvonasutus OSHIMA, * Report Term. III (1912), 83, Pl. 1, fig. 16, Pl. 2, figs. 14, 28, 29.

Eutermes (*Eutermes*) *watasei* HOLMGREN, Annot. Zool. Jap. (1912), 8, 134.

Localities.—The types from Kankao, Formosa (*Inamura* coll.), are preserved in the Institute of Science, Government of Formosa. Hozawa collected the species at Hokuzanko, Formosa, on May 23, 1911.

LIST OF PUBLICATIONS IN JAPANESE, REFERRED TO IN THIS PAPER, WITH THEIR ORIGINAL TITLES

Report Term. I. (M. Oshima.)—Daiichikwai Hakugi Chosa Hokoku. (Published by the Government of Formosa, 1909.)

Report Term. II. (M. Oshima).—Dainikwai Hakugi Chosa Hokoku. (Published by the Government of Formosa, 1911.)

Report Term. III. (M. Oshima).—Daisankwai Hakugi Chosa Hokoku. (Published by the Government of Formosa, 1912.)

Report Jap. Forestry Station.—Ringyo Shiken Hokoku. (Published by the Department of Agriculture and Commerce, Tokyo.)

Special Report Agr. Exp. Station.—Noji Shikenjo Tokubetsu Hokoku. (Published by the Agricultural Experiment Station, Government of Formosa.)

Systematic Entomology (S. Matsumura).—Konchyu Bunruigaku, Tokyo, 1907.

Thousand Insects (S. Matsumura).—Senchu Zukai, Tokyo, 1904.

The Insect World.—Konchyu Sekai. (A monthly journal published by Nawa in Gifu.)

Trans. Ent. Soc. Jap.—Nihon Konchyu Gakkwai Kwaiho, Tokyo.

Zool. Mag. Tokyo.—Dobutsugakuzassi. (A monthly journal published by the Zoological Society of Tokyo.)

ILLUSTRATIONS

TEXT FIGURES

FIG. 1. *Coptotermes kotoensis* Oshima. Mandibles of soldier. *a*, left mandible; *b*, right mandible.

2. *Coptotermes ogasawaraensis* sp. nov. Mandibles of soldier. *a*, right mandible; *b*, left mandible.

TWO SPECIES OF TERMITES FROM SINGAPORE

By MASAMITSU OSHIMA

(Of the Institute of Science, Government of Formosa)

In July, 1912, I received from Dr. C. Inagaki, of the Taihoku Hospital, and from Mr. J. Kondo, architect of the Formosan Government, a collection of termites made by them in Singapore. A study of the material showed that it represented two species, one of which is apparently an undescribed form.

Coptotermes gestroi Wasmann.

Imago.—Reddish brown above, head darker; head round, densely covered with hairs; eyes round and prominent; ocelli oval, separated from eye by a distance less than their short diameter; fontanelle indistinct, dotted, slightly elevated; antennæ 21-jointed, 2d joint longer than 3d; pronotum semicircular, slightly broader than head, emarginate in the middle of posterior border. Wing hyaline, costal margin pale brown; 11 mm. long, 3.5 mm. broad; radius running near to, and parallel with, costa; median nerve with 1 or 2 branches in apical area, scarcely reaching to tip of wing and running nearer to cubitus than to radius; cubitus with 7 branches.

Measurement.	Mm.
Length with wings	15.00
Length without wings	8.50
Length of head	1.56
Width of head	1.50
Length of pronotum	0.94
Width of pronotum	1.56

Soldier.—Head reddish yellow, suborbicular, provided with long hairs; sides converging anteriorly; a broad prominence above epistome ending in a large foramen; antennæ 14-jointed, 2d joint longer than 3d; labrum lanceolate, apex white and pointed, with a few small hairs, reaching to middle of mandibles; mandibles 1 mm. long, saber shaped, with incurved piercing tip, cutting edge smooth; gula narrow below, gradually widening toward apex, anterior border narrowed; pronotum semicircular, with bilobed anterior border, emarginate in the middle of posterior border; mesonotum as broad as pronotum, narrower than metanotum; abdomen oblong; abdominal papillæ present.

Measurement.	Mm.
Length of head	1.56
Width of head	1.46
Length of pronotum	0.50
Width of pronotum	0.94
Length of body	5.50

Worker.—Antennæ 14-jointed, 2d joint longer than 3d; pronotum much narrower than head, semicircular, with bilobed anterior border; body 5 mm. long.

Habitat.—Singapore.

Remarks.—This species is closely allied to *Coptotermes formosanus* Shiraki, but differs in the dimensions of the imago and in the width of the soldier's head. Its habit of killing gum trees is remarkable.

Termes (Macrotermes) singaporensis sp. nov.

Imago.—Head and thorax chestnut brown, in the middle of forehead a pale brownish spot; mouth parts and antennæ yellowish brown; abdomen brown, darker on dorsum, but paler along posterior margins of sternites; legs yellowish brown; head round, slightly longer than broad, with slightly concave anterior and rounded posterior borders; epistome vaulted, posterolateral angles not extending to anterior angle of head; middle of vertex slightly concave, with a small elevated median spot; eyes very large, rounded; ocelli round and prominent, distant from eyes by less than half their diameter; antennæ 19-jointed, slightly longer than head, 2d joint cylindrical, as long as 3d; labrum longer than broad, reaching to apex of mandibles, with rounded anterior border; pronotum semicircular, broader than head, with anterior border nearly straight and slightly elevated in the middle parts, posterior border arcuate and considerably concave in the middle; anterior angles depressed and obtusely rounded; mesonotum and metanotum as broad as pronotum; metanotum with markedly concave posterior border, posterior angles slightly rounded; wing-stumps moderately large, the anterior subequal to the posterior. Wing fuscous, transparent, with yellowish brown costal margin; radius running near to, and parallel with, costa; median nerve branches out from wing-stumps, and runs nearer to cubitus than to radius, giving 6 branches to posterior border of wing; cubitus running midway through wing, not reaching to apex, but giving off 12 branches; legs slender; tibiæ provided with 2 bristles at apical end, 4th joint longer than the proximal 3 joints taken together; a stout tooth-like projection present at base of apical claw.

Measurement.	Mm.
Length with wings	28.00
Length without wings	12.00
Length of head	2.19
Width of head	2.09
Length of pronotum	2.03
Width of pronotum	2.36

Soldier (*larger form*).—Head reddish brown, darker anteriorly; thorax, abdomen, and legs dark yellow; head quadrilateral, slightly narrowed anteriorly, considerably rounded on sides, dorsally vaulted, ventrally flattened; vertex inclined; in the center of head a small fontanelle present; antennæ 17-jointed, 2d joint longer than 3d; labrum lanceolate, with white apex, broader proximally than distally, not reaching to middle of mandible; mandibles shorter than half the length of head, saber shaped, with incurved and upcurved apex, with smooth cutting edge; left mandible serrated along inner basal margin; pronotum saddle-shaped, with lateral margins converging posteriorly, anterior margin bilobed and slightly convex, posterior margin emarginate at middle, anterolateral angles quadrangular, posterolateral angles broadly rounded; mesonotum broader than pronotum, oval, with distinctly bilobed posterior border; metanotum broader than mesonotum, with nearly straight posterior border; abdomen rather small, ovoid.

Measurement.	Mm.
Length of head with mandible	5.00
Length of head without mandible	3.69
Width of head	3.06
Length of pronotum	1.09
Width of pronotum	2.44
Length of body	9.50

Soldier (*smaller form*).—Head pale yellow, pronotum paler, abdomen and legs whitish; head quadrangular, slightly narrower anteriorly, with rounded posterior border, sides convex, dorsally vaulted; without fontanelle; antennæ 17-jointed, 3d joint slightly longer than 2d; labrum lanceolate, with white apex, reaching beyond middle of mandibles; mandibles slender, saber shaped, with smooth cutting edges; inner basal margin of left mandible with a few small teeth; pronotum saddle-shaped, narrower than head, its anterior border convex, with a slightly bilobed projecting portion in the middle; posterior border emarginate in the middle; anterior angles acutely rounded; posterior angles broadly rounded; mesonotum and metanotum agree with those of the larger form soldier.

Measurement.	Mm.
Length of head with mandible	3.29
Length of head without mandible	2.28
Width of head	1.97
Length of pronotum	0.98
Width of pronotum	1.47
Length of body	6.79

Worker (larger form).—Head pale yellow, round, dorsally slightly vaulted and with a pale fontanelle spot; epistome markedly swollen, along its posterior border a semilunar concavity; antennæ 18-jointed, longer than head; 2d and 3d joints cylindrical, subequal; 4th joint very small; pronotum half as long as broad, divided into 2 portions by a transverse furrow, with anterior border elevated, and forming a right angle with dorsal surface, bilobed in the middle area; anterior angles acutely rounded; lateral margins posteriorly strongly converging; posterior angles broadly rounded; middle of posterior border emarginate; mesonotum narrower than pronotum, quadrangular, with convex lateral margins; metanotum very large, semilunar, markedly broader than mesonotum, with rounded lateral margins; abdomen oblong-ovoid; abdominal papillæ short.

Measurement.	Mm.
Length of head	1.88
Width of head	1.84
Length of pronotum	0.50
Width of pronotum	1.03
Length of body	5.50

Worker (smaller form).—Head pale yellow, round, with slightly vaulted dorsal surface; antennæ 17-jointed; 2d joint cylindrical, longer than 3d.

Measurement.	Mm.
Length of head	1.16
Width of head	1.19
Length of body	4.00

Habitat.—Singapore.

Remarks.—The nearest relative of this species appears to be *Termes* (*Macrotermes*) *gilvus* Hagen, but the two species differ widely in the shape and dimensions of the thoracic segments in the same castes of each.

THE CHRYSIDIDÆ OF THE PHILIPPINE ISLANDS[1]

By A. Mocsáry
(*Budapest, Austria-Hungary*)

I received, not long ago, from Professor C. F. Baker of Los Baños, P. I., a small collection of Philippine Chrysididæ, accompanied by a letter in which he asked me to write an article on the Chrysididæ of the Philippine Islands.

1. **Ellampus (Holophris) marginellus** Mocs., Természetrajzi Füzetek. (1890), 13, 51, n. 12.

LUZON, Los Baños, duo specimina (*Baker*); etiam in Sumatra et Singapore (*Mus. Hung.*) inventus.

2. **Ellampus (Holophris) bakeri** sp. nov.

Mediocris, sat robustus, subaurato-viridis, nitidissimus, parce pilosus; pronoto margine antico anguste, centro mesonoti et abdominis segmentis dorsalibus: secundo maxima parte et tertio basi violascentibus; verticis margine postico, pronoti maxima parte postica, mesonoto et abdominis segmentis dorsalibus laevibus ac politis; cavitate faciali profunda, laevi; antennis sat crassis, haud longis, fuscis, articulis duobus primis viridibus, tertio brevi, quarto dimidio tantum adhuc longiore; fronte dense subtilius, pronoti lateribus fortius, mesopleuris sparsim crassius, scutello ac postscutello adhuc fortius profundiusque punctato-reticulatis; abdominis segmento dorsali tertio margine apicali rotundato-integro et anguste sordide-albo hyalino; ventre pedibusque aurato-viridibus, tarsis rufis; alis basi hyalinis, apice late subfumatis, venis pallide-fuscis.

♀, long. 4 mm.

Ellampo marginello Mocs. maior, magis robustus, ex parte aliter coloratus, scutello longitudinaliter non striato, iam satis distinctus.

LUZON, Los Baños, specimen unicum (*Baker*).

3. **Hedychrum stantoni** Ashmead, Can. Ent. (1904), 36, 283, ♂. Insulae Philippinae (*Ashmead*).

4. **Hedychrum philippinum** sp. nov.

Submediocre, sat robustum, cyaneo-viride, parce breviterque pilosum; vertice post stemmata nigro, pronoti fascia abbreviata,

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[1] Proof read by C. F. Baker.

antice dilatata, ante marginem posticum, mesonoti ad areas distinctas non divisi scutellique medio, postscutello et abdominis segmentis dorsalibus: primo basi centro et secundo macula magna discoidali tertioque vitta centrali violascentibus; cavitate faciali profunda, dense concinne transverse striata; antennis tenuibus, fuscis, cano-puberulis, articulis duobus primis cyaneis, tertio longo, 4-5 simul sumptis aequilongo; genis linearibus, fere nullis; pronoto longo, capite multo longiore, sed eius latitudinis, transverse rectangulo, lateribus ante medium sinuatis; postscutello gibbo-convexo; metanoti dentibus postico-lateralibus longis, acute triangularibus, spiniferis, externe profunde, postice levius sinuatis; fronte verticeque valde dense subtiliter, pronoto cum mesonoto scutelloque parum dispersius crassius profundiusque, postscutello adhuc fortius punctato-reticulatis; mesopleuris punctatura pronoti; abdominis segmentis dorsalibus: primo dense subtiliter, lateribus multo fortius rugosiuscule punctato, basi centro canalicula longitudinali laevi ac polita, secundo carinula mediana nulla, disco parum disperse, haud crasse, sed profunde aequaliter punctato, tertio punctatura densiore subtilioreque rugulosa, ante marginem apicalem arcuatim impresso, lateribus utrinque sine dente distincto, sed tantum angulatis; ventre nigro-aeneo, nitido, sparsim punctulato, segmentis centro macula viridi; femoribus tibiisque subaurato-viridibus, tarsis fuscis; alis basi hyalinis, parte apicali leviter fumatis, venis piceis.

♀, long. 5 mm.

Species: pronoto, metanoti dentibus postico-lateralibus et praesertim de punctatura segmenti dorsalis secundi abdominis facile cognoscitur. Species enim huius generis asiaticae, mihi cognitae, punctatura multo subtiliore gaudent.

LUZON, Los Baños, specimen unicum (*Baker*).

5. **Stilbum cyanurum** Forst. var. **amethystinum** Fabr.

LUZON, Los Baños (*Baker*), 11 specimina. Varietas haec fere totam Africam Asiamque inhabitat. Etiam in America sept., inventum est.

6. **Stilbum cyanurum** Forst. var. **flammiceps** var. nov.

Praecedenti penitus simile, sed capite toto concinne ignito. LUZON, Los Baños, specimen unicum (*Baker*).

7. **Chrysis (Holochrysis) philippinensis** Bisch., Mittheil. Kgl. Zoolog. Museum Berlin (1910), 4, 452, ♀.

LUZON (*Bisch.*).

8. **Chrysis (Dichrysis) bidenticulata** sp. nov.

Submediocris, elongata, minus robusta, parallella, cyaneoviridis, parce breviterque albido-pilosa; macula ad stemmata, occipitis medio, collo, fascia non satis distincta pronoti, mesonoti lobo medio, macula parva scutelli, fascia mediana indeterminata abbreviataque abdominis segmentorum dorsalium primo, macula magna secundi et tertio basi violascentibus; cavitate faciali subangusta, sed profunda, dense subtiliter punctato-coriacea, lateribus argenteo-sericeo pilosa, superne arcuatim acute marginata, margine aream transversam reniformem eximiam, a stemmatibus longe remotam, includente; antennis brevibus, tenuibus, fuscis, cano-puberulis, articulis tribus primis aurato-viridibus, tertio proportionaliter brevi, secundo dimidio tantum longiore; genis brevibus, fere nullis; pronoto sat longo, transverse rectangulo, angulis obtusis, lateribus acute marginatis medioque sinuatis, antice in medio vix impresso, capite breviore, sed fere aequilato; postscutello gibbo-convexo, metanoti dentibus postico-lateralibus sat longis, acute-triangularibus, externe truncatis, postice leviter sinuatis; mesopleuris normalibus, undique acute marginatis; vertice ac pronoto dense minus fortiter, mesonoto cum scutello postscutelloque parum dispersius, sed fortius sat profunde punctato-reticulatis; abdominis segmentis dorsalibus: primo basi triimpresso, dense sat profunde, secundo parum subtilius rugosiuscule punctato, carinula mediana indistincta, angulis postico-lateralibus rectis, tertio dense subtilius irregulariter rugosiuscule punctato, convexo, ante seriem leniter incrassato, foveolis sat profunde immersis mediocribus, haud numerosis, 10 tantum distinctis, orbiculatis, centralibus maioribus, margine apicali valde brevi, dense punctulato et leniter arcuato lateribus a margine parum remotis utrinque denticulo parvo triangulari armatis; ventre pedibusque subaurato-viridibus, illo segmentis secundo basi utrinque et tertio apice nigromaculatis, his tarsis fuscis; alis hyalinis, venis piceis, cellula radiali lanceolata subcompleta, tegulis viridi-cyaneis.

♂, long. 6 mm.

Species: de cavitate faciali, area insigni frontali, genis, pronoto, punctatura abdominis et dentibus analibus facillime cognoscitur.

LUZON, Los Baños, tria specimina conformia (*Baker*).

9. **Chrysis (Trichrysis) sauteri** Mocs., Annal. Mus. Hung. (1912), 10, 381, n. 53.

LUZON, Los Baños, specimen unicum (*Baker*).

Ex insula Formosa descripta.

10. **Chrysis (Trichrysis) singalensis** Mocs., Monogr. Chrysid. (1889), 324, n. 363.

LUZON (*Buysson*), (*Bisch.*). Praeterea in India or. et Java.

11. **Chrysis (Trichrysis) luzonica** Mocs., Monogr. Chrysid. (1889), 328, n. 369.

LUZON (*Mocsáry*); Los Baños (*Baker*).

12. **Chrysis (Trichrysis) aspera** Brullé, Hist. nat. d. Insectes. Suites à Buffon. Hyménoptères (1846), 4, 46, n. 35. Mocsáry, Monogr. Chrysid. (1889), 328, n. 369, ♀.

LUZON, Manila (*Brullé*).

13. **Chrysis (Trichrysis) miri** Brown, Phil. Journ. Sci. (1906), 1, 685, ♂.

LUZON, Manila (*Brown*).

14. **Chrysis (Trichrysis) bakeri** sp. nov.

Submediocris, elongata, parallella, minus robusta, cyaneoviridis, parce breviterque albo-pilosa; vertice ad ocellos et mesonoti lobo medio nigro-violaceis; mesonoti lobis lateralibus et abdominis segmentis dorsalibus duobus primis in lateribus et secundo etiam margine apicali anguste viridi-subauratis; occipitis medio et segmento secundo maxima parte cyaneis; cavitate faciali subangusta, sed profunda, dense subtilissime transverse striata, lateribus punctato-coriacea et argenteo-sericeo pilosa, superne arcuatim acute marginata, margine ramulum utrinque non satis distinctum et stemma anticum includentem emittente; antennis brevibus, sat tenuibus, fuscis, cano-puberulis, articulis tribus primis viridi-auratis, tertio mediocri, secundo dimidio adhuc longiore; genis brevibus, linearibus; pronoto brevi, transverse rectangulo, angulis acutis, antice in medio profundius impresso, lateribus acute marginatis medioque sinuatis, capite multo breviore, sed vix angustiore; postscutello convexo, metanoti dentibus postico-lateralibus acutis subspiniformibus; mesopleuris normalibus, undique acute marginatis; vertice parum subtilius, thorace toto fere aequaliter dense minus crasse ac profunde punctato-reticulatis; abdominis segmentis dorsalibus: primo dense minus crasse ac profunde punctato et basi longitudinaliter canaliculato, canalicula laevi ac polita, secundo dense rugosiuscule subtilius punctato, carinula mediana indistincta, angulis postico-lateralibus rectis, tertio convexo, punctatura fere secundi, sed parum fortiore, confusa, supra seriem incrassato, foveolis sat profunde immersis, paucis, sex tantum distinctis, duobus centralibus magnis, reliquis multo minoribus, orbiculatis, per carinulam medianam in spinam sat longam acutam productam interruptis, margine apicali hoc modo tridenticulato, denticulis lateralibus brevibus acute triangularibus, lateribus ante dentem externum lenissime sinuatis; ventre pedibusque subaurato-viridibus, illo segmento secundo basi utrinque nigromaculato, his tarsis fuscis; alis hyalinis, venis fuscis, cellula radiali lanceolata completa, tegulis subaurato-viridibus.

♂, long. 5.5 mm.

Chrysidibus singalensi Mocs. et luzonicae Mocs. similis et affinis; sed a priore minor, magis gracilis, fronte areata, corpore toto subtilius punctato, abdominis segmentis dorsalibus: secundo carinula mediana indistincta, tertio utrinque transverse non impresso, dentibus analibus gracilioribus; a luzonica vero: colore ex parte, corpore graciliore, punctatura abdominis segmentorum dorsalium multo subtiliore, dentibus analibus longioribus magisve acutis, praesertim distincta.

LUZON, Los Baños, specimen unicum (*Baker*).

15. **Chrysis (Tetrachrysis) fuscipennis** Brullé, Hym. (1846), 4, 38, n. 24, ♀; Mocsáry, Monogr. Chrysid. (1889), 370, n. 424, ♂ ♀.

Insulae Philippinae (*Brullé*); LUZON (*Mocsáry*), Los Baños (*Baker*). Fere e tota Asia Australiaque cognita.

16. **Chrysis (Tetrachrysis) diademata** Mocsáry, Monogr. Chrysid. (1889), 414, n. 489, ♂.

Insulae Philippinae (*Mocsáry*).

17. **Chrysis (Tetrachrysis) atrata** Bisch., Mittheil. Kgl. Zoolog. Museum Berlin (1910), 475, ♂.

LUZON (*Bisch.*).

18. **Chrysis (Pentachrysis) lusca** Fabr., Syst. Piez. (1804), 171, n. 7; Mocs., Monogr. Chrysid. (1889), 527, n. 618, ♂ ♀.

Insulae Philippinae (*Bisch.*). Inde ab India orientali in magna parte Asiae diffusa.

19. **Chrysis (Pentachrysis) palawanensis** Mocs., Term. Füzetek. (1899), 22, 487, ♀.

Insulae Philippinae (*Mocsáry*).

20. **Chrysis (Hexachrysis) comottii** Grib. var. **igniceps** Mocs., Term. Füzetek (1892), 15, 233, n. 28, ♀.

Insulae Philippinae (*Mocsáry*); LUZON, Manila (*Bisch.*).

21. **Chrysis (Hexachrysis) laevicollis** Buyss., Ann. Soc. Ent. France (1897), 560. (An *C. lynceae* F. var. ?)

LUZON (*Buysson*).

NEW GENERA AND SPECIES OF PSYLLIDÆ FROM THE PHILIPPINE ISLANDS[1]

By D. L. CRAWFORD
(*Cornell University, Ithaca, New York*)

One plate and 1 text figure

Professor C. F. Baker of the College of Agriculture, Los Baños, P. I., recently sent me some specimens of a very interesting psyllid which he had collected on leaves of *Ficus ulmifolia* Lam.

This species of Psyllidæ bears some resemblance to the members of the genus *Pauropsylla*, which are more or less tropical in distribution; and most, if not all, of them produce malformations on the leaves of various trees—*Ficus* among others. Several Psyllid larvæ have been mentioned as making galls on leaves of various species of *Ficus* in Java, and it is possible that the specimens before me are the adults of one of these species. However, none of these forms has been named, so that no confusion will result from assigning a name to the Philippine species.

A second collection of Psyllidæ from the Philippine Islands, sent by Professor Baker, contains some very interesting forms. There is represented in the collection one new and very interesting genus, as well as a new species of a genus described from Formosa, an interesting new species of *Pauropsylla*, and one new species of another genus, *Euphalerus*. The new species of *Pauropsylla* is especially interesting because of the light it throws upon the value of certain venational characters.

Genus **PAUROCEPHALA** novum

Body robust, surface shagreened; thorax strongly arched; head very strongly deflexed, not quite as broad as thorax; vertex convex in front, coarsely shagreened; front globosely swollen beneath antennal insertions, lobes or cones wanting; labrum large. Eyes large, globose; ocelli large, prominent, posterior pair elevated, anterior in front; antennæ longer than width of head; rostrum very long, prominent. Thorax broad; propleurites similar to those of *Pauropsylla;* metascutum with a prominent, erect, conical, tubercle dorsad. Wings hyaline, more or less oval in shape, rounded apically; pterostigma present. Genitalia of male simple; anal valve and claspers without processes.

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[1] Proof read by C. F. Baker.

Type of genus: *Paurocephala psylloptera* sp. nov.

Paurocephala psylloptera sp. nov.

Length of body, 1.7 mm.; length of forewing, 2.1 mm. Male much darker than female, almost uniformly dark reddish brown, with anterior femora and a spot above forewings yellowish; abdomen lighter; female orange to light reddish brown; antennæ, tibiæ, and eyes brown. Body sparsely and briefly pubescent.

Head greatly deflexed, almost perpendicular; vertex broader than long, surface irregular, deeply concave on occipital margin, with posterior ocelli greatly elevated, roundly convex in front; anterior ocellus large, between antennal bases; frons swollen beneath antennal insertions; labrum very large, globose from in front. Antennæ nearly twice as long as width of head, slender.

Thorax broad, strongly arched; pronotum long, ascending, longest at center; dorsulum long. Metascutum with a prominent, acute, erect, conical process dorsad. Mesosternum very large, extending far ventrad, rostrum projecting forward beneath head. Legs slender; hind legs very long; hind tibiæ very spinose. Forewings hyaline, narrowed basally, broadest subapically, broadly rounded or slightly angular on apical margin, more than two and a half times as long as broad; cubital petiole and discoidal subcosta equal in length; first marginal cell elongate, narrow, a little longer than pterostigma; second broad and large.

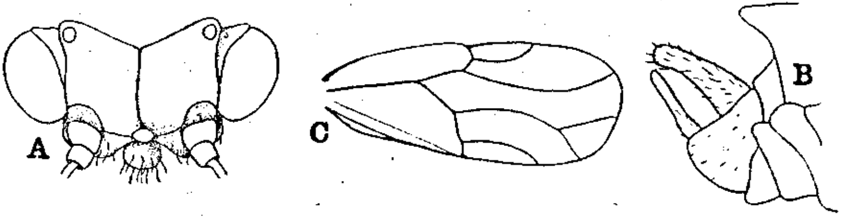

FIG. 1. *Paurocephala psylloptera* Crawford. A, head, front view; B, male genitalia; C, forewing.

Abdomen long. Male: fifth tergite produced caudad over genital plate; anal valve simple, longer than claspers which are slender, arched, pubescent within. Female genitalia flexed sharply downward, rather long; both plates acute at tip, dorsal longer than ventral.

Described from 3 males and 3 females from Los Baños, P. I. (*Baker*, August, 1912). Collected on *Ficus ulmifolia*.

Genus **DYNOPSYLLA** novum

Body large, robust, pubescent. Head very deeply cleft in front between antennæ; vertex very deeply depressed between posterior ocelli, with a horn-like process in front of each posterior ocellus directed forward and upward; genal cones wanting; frons small, elliptical. Eyes and ocelli large. Antennæ very long, longer than body or at least as long, slender; basal segment very elongate and large, much longer than II. Thorax broad; pronotum short, much depressed below dorsulum. Legs stout and large; hind tibiæ unarmed at base, but with several very large spines at apex. Forewings membranous, very large, powerful, angulate at apex, veins heavy; venation atypical; hind wings much smaller, frenulum conspicuous.

Type of genus: *Dynopsylla cornuta* sp. nov.

This genus belongs to the subfamily Carsidarinæ, being related rather closely to several genera therein, including *Carsidara.* The absence of the basal spur on the hind tibiæ, I believe, is of minor importance.

Dynopsylla cornuta sp. nov. (Plate I, figs. A, E, H, I, M.)

Length of body, 3.8 mm.; length of forewing, 4.9 mm.; width of head with eyes, 1.2 mm.; length of basal segment of antennæ, 0.5 mm.; flagellum, 5.8 mm. General color dark reddish brown; genæ, pleura, femora, tibiæ, and basal half of flagellum light brown; notum with lighter stripes. Body very large and robust; head, basal antennal segment, thorax, venter of abdomen, genital segment, legs, and wing veins with long pubescence.

Head much narrower than thorax, short, relatively small, very deeply cleft in front and above, with anterior ocellus in front at base of cleft and posterior ocelli much elevated; vertex produced into a large horn-like process in front of each posterior ocellus and closely behind antennal insertions. Frons small, elliptical, covered by genæ except around front ocellus; genæ very large, long, produced forward on inner margin of antennal insertions; clypeus small, situated far back. Eyes large. Antennæ as long as body to tip of wings, one-half longer than body alone, slender; basal segment unusually long and large, more than three times as long as II; III–VI subequal in length; VII–VIII a little shorter than preceding ones; IX–X short; terminal setæ very short.

Thorax large, stout, strongly arched; pronotum short, greatly depressed below dorsulum; metascutellum large, with 2 short cariniform processes above for supporting the wings. Legs large, stout, relatively short, hairy; femora deeply grooved for reception of tibiæ; fore and second tibiæ with a fringe of stiff spines at apex; hind tibiæ with 4 very large spur-like spines at apex within; tarsi very large and long.

Wings large, membranous, about two and a half times as long as broad, acute at apex, veins large, setigerous; first marginal cell very large; first cubital very short; radius touching second cubital, and latter touching second furcal; with dark bands, as shown in the figure.

Abdomen large. Male genital segment relatively small; claspers short, broader at apex than at base, rather flat; apical margin rather square; anal valve longer than claspers, constricted near apex. Female genital segment about half as long as rest of abdomen, subacute at apex, dorsal plate slightly longer than ventral.

Described from 2 males and 1 female collected at Los Baños, P. I. (*Baker*, December, 1912).

Pauropsylla triozoptera sp. nov. (Plate I, figs. B, C, J, N.)

Length of body, 2.5 mm.; length of forewing, 3.6 mm.; width of vertex with eyes, 0.95 mm. General color dark reddish brown, vertex lighter; metapleurum, metasternum, legs, and basal half of antennæ yellowish brown. Body robust, surface smooth, sparsely pubescent.

Head nearly as broad as thorax, short, deeply concavely depressed between posterior ocelli, front margin convex; vertex much broader than long; frons visible from ocellus to clypeus, narrow. Genal cones wanting. Eyes and ocelli large, prominent; antennæ about as long as head and thorax combined, slender; segment IX broadened at tip, bearing a long seta apically without.

Thorax very thick dorsoventrally; mesosternum extending far down and forward; pronotum much depressed below dorsulum. Legs moderately long. Forewings large, membranous, hyaline, rhomboidal, rather square at apex, about one and two-thirds times as long as broad; venation similar to that of congeners except that the cubital petiole is wanting, as in *Trioza*.

Female genital segment nearly as long as rest of abdomen, deflexed, acute at apex, plates subequal in length.

Described from 1 female from Los Baños, P. I. (*Baker*).

Although this species differs from others of the genus *Pauropsylla* in one venational character which has been considered of great diagnostic importance, nevertheless I do not hesitate to include it in this genus because of the unquestionably close relationship in all other respects. In *P. depressa* Crawford the cubital petiole is very short, approaching the condition found in the present species. This is only another bit of evidence showing that too much importance has been ascribed to such venational characters.

Pauropsylla triozoptera setifera var. nov.

Corresponds very closely with the species in nearly every respect except the following. Veins of forewing set with conspicuous setæ; often all of the veins setigerous, but sometimes only a part of them. Dorsum of thorax more pubescent than in the species. Claspers of male stouter and larger. Male in some cases very light colored and the female sometimes dark.

There seems to be more or less gradation in the number of setæ on the wing veins. In some specimens of the species there may be seen a very few widely scattered hairs, but usually the veins are entirely without them. However, in some specimens of the variety the number is reduced, but never to such an extent as in the species.

Described from 3 males and 4 females collected on the leaves of *Columbia serratifolia* DC.,[2] Los Baños, P. I. (*Baker*).

Epipsylla pulchra sp. nov. (Plate I, figs. D, G, K, O.)

Length of body, 2.3 mm.; length of forewing, 3.1 mm.; width of head with eyes, 0.93 mm. General color light reddish brown, with 2 conspicuous white stripes bordered narrowly by black extending from the tip of genal cones along vertex and notum and uniting on metascutellum; another similar short stripe from each posterior ocellus to antennal insertion; a third pair on under and outer side of cone beneath antennal insertion. Body surface covered sparsely with stiff black hairs.

Head about as broad as thorax, moderately long, somewhat deflexed; vertex fully half as long as broad between eyes, slightly depressed along each white stripe; cones only slightly longer than vertex, divergent, subacute, porrect, pubescent. Antennæ about twice as long as body without wings, very slender, segment VIII longest.

Thorax arched; propleurites very narrow, as in *Psylla*. Legs slender, wings membranous, rounded at apex, two and a third times as long as broad, light brown throughout; veins slightly setigerous; pterostigma wanting.

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[2] Determined by Mr. E. D. Merrill.

Male genital segment moderately large; claspers slender, flattened a little distad, with a second smaller pair between them; latter more slender, shorter, flattened at apex; anal valve broad, large, somewhat longer than claspers.

Described from 1 male from Los Baños, P. I. (*Baker*).

This is apparently very closely related to *Epipsylla albolineata* Kuwayama[3] from Formosa. The chief differences between the two species are: the two additional pairs of stripes in *pulchra*, size of vertex and cones, color of wings and male genitalia; only one pair of claspers is mentioned for *E. albolineata*.

Euphalerus nigrivittatus sp. nov. (Plate I, figs. F, L.)

Length of body, 2.8 mm.; length of forewing, 3 mm.; width of head with eyes, 1.1 mm. General color whitish, with a black vitta on each side of body extending from tip of cone along side of same over eye and side of thorax, the two vittæ uniting on mesonotum and extending on dorsum of abdomen; vitta continued along posterior margin of forewing around apical margin; anterior and mid tarsi black. Surface of body finely reticulated.

Head about as broad as thorax, continuing descending plane of notum, with cones about as long as broad between eyes, with a small foveal impression on each side of median line near center; cones broader than long, not deflexed nor depressed below plane of vertex, almost contiguous on inner margin, rather square on apical margin, pubescent. Antennæ about as long as body, slender.

Thorax broad, robust, somewhat arched. Propleurites rather narrow, partially concealed by the large eyes. Forewings large, hyaline, about half as broad as long, slightly rhomboidal, veins setigerous; marginal cells long; pterostigma very small; black stripe narrow on posterior margin, broader on apical and extending into radial cell.

Abdomen large. Female genital segment about half as long as rest of abdomen, rather thick, ventral plate slightly shorter than dorsal.

Described from 1 female from Los Baños, P. I. (*Baker*).

This bears some resemblance to an Indian species of this same genus, *E. vittatus* Crawford,[4] but is much larger and differs in several characters, such as shape of forewing, antennæ, and sculpturing of vertex.

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[3] *Trans. Sapporo Nat. Hist. Soc.* (1907), 2, 178.

[4] *Records Indian Mus.* (1912), 7, 423, 431.

Euphalerus citri (Kuwayama).

Diaphorina citri KUWAYAMA, Trans. Sapporo Nat. Hist. Soc. (1907), 2, 160.

Euphalerus citri (KUWAYAMA) CRAWFORD, Records Indian Mus. (1912), 7, 424.

This species is mentioned here because of its occurrence in the Philippine Islands. Many specimens were collected several years ago on *Citrus* in Luzon by Mr. George Compere. This fact is mentioned in the second article cited above. The species is probably of general distribution throughout the Orient.

ILLUSTRATIONS

PLATE I

FIG. A. *Dynopsylla cornuta* Crawford. Forewing.
B. *Pauropsylla triozoptera* Crawford. Forewing.
C. *Pauropsylla triozoptera* Crawford. Apex of left antenna.
D. *Epipsylla pulchra* Crawford. Male claspers, rear view.
E. *Dynopsylla cornuta* Crawford. Head and prothorax, lateral view.
F. *Euphalerus nigrivittatus* Crawford. Forewing.
G. *Epipsylla pulchra* Crawford. Forewing.
H. *Dynopsylla cornuta* Crawford. Head, front view.
I. *Dynopsylla cornuta* Crawford. Tip of hind tibia and basal tarsal segment.
J. *Pauropsylla triozoptera* Crawford. Head, front view.
K. *Epipsylla pulchra* Crawford. Male genitalia, lateral view.
L. *Euphalerus nigrivittatus* Crawford. Head, dorsal view.
M. *Dynopsylla cornuta* Crawford. Male genitalia, lateral view.
N. *Pauropsylla triozoptera* Crawford. Head and prothorax, lateral view.
O. *Epipsylla pulchra* Crawford. Head, lateral view.

TEXT FIGURE

FIG. 1. *Paurocephala psylloptera* Crawford. A, head, front view; B, male genitalia; C, forewing.

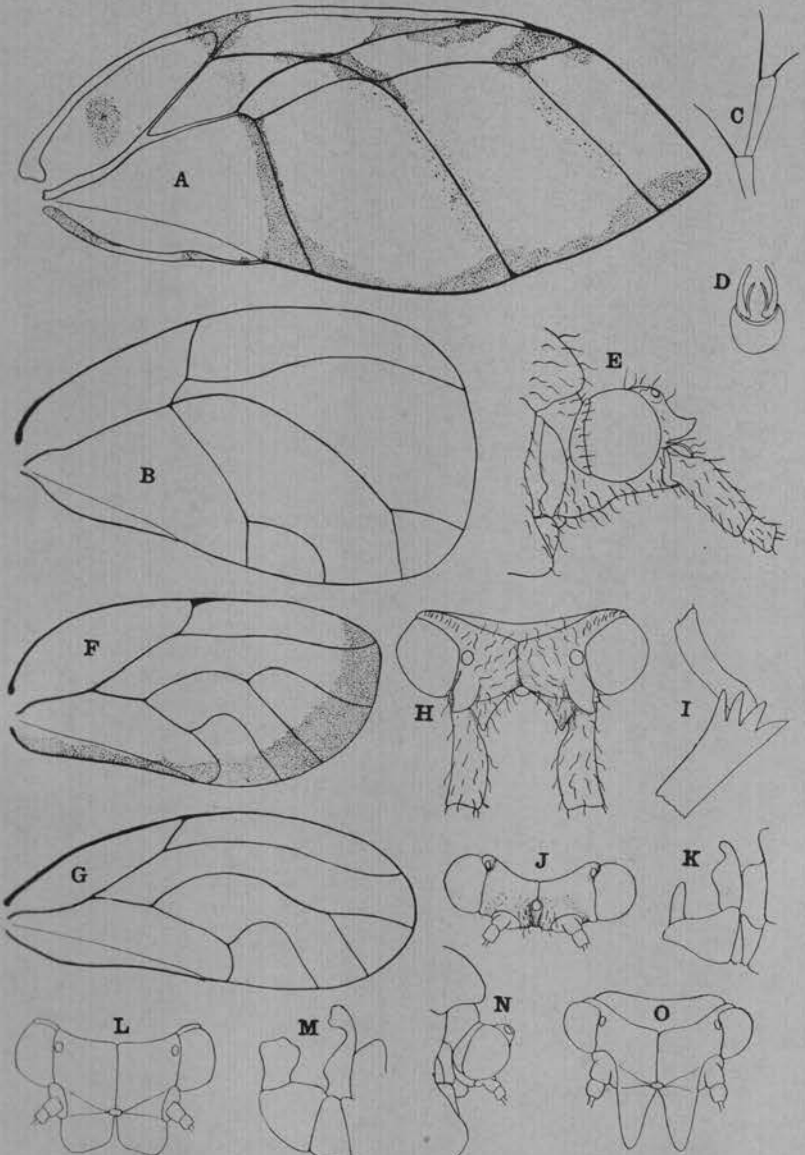

PLATE I. DETAILS OF NEW PHILIPPINE PSYLLIDÆ.

ZWEI NEUE PHILIPPINISCHE CLERIDEN

Von SIGMUND SCHENKLING
(Berlin-Dahlem)

Callimerus schultzei sp. nov.

Niger, supra densissime albo- vel ochraceo-squamosus, ore, antennis pedibusque albis, prothoracis linea mediana elytrorumque limbo et lineis tribus curvatis denudatis.

Long. 6-6.5 mm.

LUZON, Benguet, Baguio (*Charles S. Banks*).

Typus No. 1598 in der Entomologischen Sammlung des Bureau of Science, Manila.

Cotypen (No. 1392, Negros Occ., Bago; *Charles S. Banks*) im Deutschen Entomologischen Museum zu Berlin-Dahlem.

Gehört in die Gruppe *C. gratiosus-pulchellus*, die gleichfalls auf den Philippinen vorkommen und bei denen die Oberseite ebenfalls sehr dicht beschuppt und ausserdem dicht behaart ist. Bei frischen, unabgeriebenen Stücken ist der Kopf ganz dicht beschuppt, auf dem Halsschild scheint aber die Längsmitte stets unbeschuppt zu sein. Auf den Flügeldecken sind ausser Naht und Rand 3 gebogene Querlinien kahl und daher schwarz, nämlich: eine hufeisenförmige Binde (Öffnung nach der Basis der Flügeldecken) im vorderen Fünftel, die Basis nicht erreichend; eine kurze, ziemlich breite Querbinde dicht hinter der Mitte, die nicht ganz bis zur Längsmittellinie der Flügeldecken reicht und hier in eine halbmondförmig gekrümmte Binde übergeht, deren Enden die Naht nicht erreichen und deren vorderer Arm etwas länger ist als der hintere; endlich eine Querbinde im hinteren Fünftel, die die Naht gleichfalls nicht erreicht; alle 3 Binden stehen mit dem kahlen Seitenrande in Verbindung. Die Flügeldecken lassen auf den kahlen Stellen eine dichte, ziemlich grobe Punktierung erkennen. Brust und Hinterleib an den Seiten dicht weiss oder gelblich beschuppt. Beine lang, hell behaart.

Ich widme diese Art freundschaftlich Herrn W. Schultze, Assistent für Entomologie am Bureau of Science in Manila.

Dasyceroclerus banksi sp. nov.

Flavo-brunneus, supra longe nigro et albo setosus, antennis brunneis, articulis duobus flavis, elytris seriatim punctatis, flavis, humeris fasciisque duabus, e maculis longitudinalibus compositis, nigris vel brunneis, pedibus albis, femorum apice, tibiarum anteriorum annulo tarsisque brunneis vel nigris.

Long. 6–7 mm.

PALAWAN, Bacuit (*C. M. Weber*).

Typus No. 12364 in der Entomologischen Sammlung des Bureau of Science, Manila.

Cotypen im Deutschen Entomologischen Museum zu Berlin-Dahlem.

Unter der Artengruppe, deren Mittelschienen auf der Mitte dunkel geringt sind, leicht an der Färbung kenntlich. Die Glieder der dunkeln, aber meist durchscheinenden Fühler dünn, fast parallel, einzeln lang behaart, das Endglied allmählich zu einer stumpfen Spitze verschmälert, 1½ mal so lang als das vorhergehende. Die gange Oberseite mit aufgerichteten langen schwarzen, an den Körperseiten weissen Borsten. Halsschild oben ziemlich gleichmässig gewölbt, braungelb, kurz dicht graugelb behaart, auf den in der Mitte gerundet erweiterten Seiten mit einem Grübchen. Flügeldecken vor der Mitte etwas eingedrückt, mit regelmässigen Reihen ziemlich feiner Punkte, die Punktierung hinter der Mitte mehr einzeln und zuletzt erlöschend. Die am Ende zugespitzten Flügeldecken sind braungelb und wie der Halsschild dicht kurz gelblich behaart, die Schultern (mitunter der halbe Basalrand) und zwei aus Längsflecken zusammengesetzte Querbinden hinter der Mitte schwarz oder braun, zuweilen auch ein runder Fleck hinter dem Schildchen jederseits der Naht schwarz. Unterseite braungelb, Brust schwärzlich. Beine weissgelb, die Schenkelspitze, ein Ring auf der Mitte der Vorder- und Mittelschienen und die Tarsen dunkel.

Herrn Charles S. Banks, Entomologist des Bureau of Science, Manila, gewidmet.

STUDIES IN PHILIPPINE DIPTERA, I *

By M. Bezzi

(*Turin, Italy*)

An extended series of studies on Philippine Diptera has been made possible by copious material furnished by Professor C. F. Baker, nearly all which has been taken in the vicinity of Los Baños, Laguna Province, Philippine Islands, by Julian Valdez y Hernandez, Professor Baker's Cuban collector.

It seems advisable to preface this series of papers with an enumeration of the species of Diptera hitherto known from the Philippine Islands. In his paper of 1882 Osten Sacken[1] brought together all that was then known of the Diptera of the Islands, and added much to the then scant knowledge of this region. The collection studied by him contained about 250 species, only a few of them described. Formerly this collection was in Turin in the hands of the late Professor L. Bellardi. In the Bellardi collection, now in the University Museum, some of this Philippine material is yet to be found. In the general work of 1895 by Elera[2] nothing is added to the Diptera; and but few species, except in one family, have been added subsequently by Brues, Ricardo, and Speiser. In one family, the Culicidæ, numbers of species have been described by Giles, Ludlow, C. S. Banks, and Knab.

CATALOGUE OF THE DIPTERA HITHERTO RECORDED FROM THE PHILIPPINE ISLANDS

BIBIONIDÆ[3]

Plecia fulvicollis Fabr. 1805.

TENDIPEDIDÆ (CHIRONOMIDÆ)

Tendipes trochanteratus Thoms. 1869. *Pelopia manilensis* Schin. 1868.

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* Proof read by C. F. Baker.

[1] Diptera from the Philippine Islands brought home by Dr. Carl Semper. *Berl. ent. Zeitschr.* (1882), 26, 83–120 and 187–252.

[2] See the account by Dyar, *Journ. N. Y. Ent. Soc.* (1904), 12, 58–59.

[3] Osten Sacken records also an undetermined *Lycoria* (*Sciara*).

CULICIDÆ

ANOPHELINÆ

Anopheles pallidus Ludl. 1905.

Anopheles formosus Ludl. 1909.

Myzorhynchus pseudobarbirostris Ludl. 1902.

Myzorhynchus barbirostris Wulp. 1884.

Myzorhynchus sinensis Wied. 1828.

Myzorhynchus vanus Wulp. 1860.

Myzorhynchus ? mcgregori Banks 1909.

Myzomyia rossii Giles 1899.

Myzomyia rossii indefinata Ludl. 1904.

Myzomyia rossii mangyana Banks 1906.

Myzomyia ludlowii Theob. 1903.

Myzomyia thorntonii Ludl. 1904.

Myzomyia ? funestus Giles 1900.

Nyssorhynchus theobaldii Giles 1901.

Nyssorhynchus fuliginosus Giles 1901.

Nyssorhynchus philippinensis Ludl. 1902.

Nyssorhynchus freeræ Banks 1906.

Nyssorhynchus lineatus Ludl. 1908.

Nyssorhynchus stephensii Liston 1901.

Nyssorhynchus flavus Ludl. 1908.

Nyssorhynchus ? kochii Don. 1901.

MEGARHININÆ

Toxorhynchites lewaldii Ludl. 1904.

Toxorhynchites argenteotarsis Ludl. 1906.

Toxorhynchites (Worcesteria) gratus Banks 1906.

CULICINÆ[4]

Banksinella luteolateralis Theob. 1901.

Stegomyia fasciata Fabr. 1805.

Stegomyia fasciata persistans Banks 1908.

Stegomyia scutellaris Walk. 1859.

Stegomyia amesii Ludl. 1903.

Stegomyia aurostriata Banks 1906.

Stegomyia punctolateralis Theob. 1903.

Stegomyia crassipes Wulp. 1892.

Stegomyia leucomeres Giles 1904.

Stegomyia striocrura Giles 1904.

Stegomyia desmotes Giles 1904.

Stegomyia nigritia Ludl. 1910.

Stegomyia quasinigritia Ludl. 1911.

Kingia gregoryi Ludl.

Blanchardiomyia obturbans Walk. 1860.

Blanchardiomyia fusca Theob. 1903.

Blanchardiomyia joloensis Ludl. 1904.

Blanchardiomyia panalectoros Giles 1901.[5]

Howardina (Scutomyia) nivea Ludl. 1903.

Howardina (Scutomyia) samarensis Ludl. 1903.

Quasistegomyia gardnerii Ludl. 1905.

Neomacleaya indica Theob. 1907.

Popea lutea Ludl. 1905.

Hulecoeteomyia pseudotæniata Giles 1901.

Ochlerotatus (Finlaya) poicilia Theob. 1903.

Ochlerotatus (Finlaya) flavipennis Giles 1904.

Ochlerotatus (Finlaya) melanoptera Giles 1906.

Ochlerotatus (Finlaya) aranetana Banks.

Ochlerotatus (Reedomyia) pampangensis Ludl. 1906.

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[4] There is also recorded *Mucidus mucidus* Karsch, which, however, seems doubtful.

[5] *Grabhamia spenceri* is a North American species.

Ochlerotatus (*Reedomyia*) *niveoscutellata* Theob.
Ochlerotatus (*Pecomyia*) *cæca* Theob. 1901.
Ochlerotatus (*Pseudoskusea*) *nigritarsis* Ludl. 1908.
Ochlerotatus (*Duttonia*) *alboannulis* Ludl. 1911.
Mansonioides uniformis Theob. 1901.
Mansonioides chrysogona Knab. 1909.
Mansonioides annulipes Walk. 1857.
Mansonioides annulifera Theob. 1901.
Etorleptiomyia luzonensis Ludl. 1905.
Aedomyia catasticta Knab 1909 (*squammipenna* Arrib.).
Tæniorhynchus argenteus Ludl. 1905.
Tæniorhynchus lineatopennis Ludl. 1905.
Tæniorhynchus aureosquamatus Ludl. 1909.
Tæniorhynchus ager Giles 1901.
Tæniorhynchus pagei Ludl. 1910.
Chrysoconops aurites Theob. 1901.
Chrysoconops conopus Frauenf. 1867.
Culex microannulatus Theob. 1901.
Culex vishnui Theob. 1908.
Culex sitiens Wied. 1828.
Culex impellens Walk. 1860.
Culex ludlowi Blanch. 1905 (*annuliferus* Ludl.).
Culex alis Theob. 1903.
Culex annulioris Theob. 1901.
Culex hirsutus Theob. 1901.
Culex vagans Wied. 1828.
Culex rubrithorax Meig. 1850.
Culex argentinotus Banks 1909.
Culex taytayensis Banks 1909.
Culex auropunctis Ludl. 1910.
Culex fatigans Wied. 1828.
Culex concolor Desv. 1825.
Culex tigripes Grandpr. 1900.
Culex fragilis Ludl. 1903.
Culex rizali Banks 1906.
Theobaldiomyia gelida Theob. 1901.
Theobaldiomyia gelida var. *cuneata* Theob. 1901.
Theobaldiomyia whitmorei Giles 1904.
Oculiomyia fulleri Ludl. 1909.
Pardomyia quadripunctis Ludl. 1910.
Hodgesia niveocapitis Ludl. 1911.
Mimomyia (*Ludlowia*) *chamberlainii* Ludl. 1904.
Mimomyia (*Ludlowia*) *minima* Ludl. 1907.
Uranotænia falcipes Banks 1906.
Uranotænia lateralis Ludl. 1905.
Uranotænia cæruleocephala Theob. 1901.
Uranotænia powelli Ludl. 1909.
Uranotænia ? *philippinensis* Giles 1904.
Pseudouranotænia parangensis Ludl. 1908.
Pseudouranotænia triangulata Ludl. 1908.
Anisocheleomyia albitarsis Ludl. 1905.
Harpagomyia cæruleovittata Ludl. 1905.

SABETHINÆ

Wyeomyia nepenthicola Banks.
? *Dendromyia scintillans* Ludl. 1904.

CHAOBORINÆ

Chaoborus manilensis Schin. 1868.

TIPULIDÆ

Dicranomyia saltans Dol. 1857.
Libnotes semperi O. S. 1882.
Libnotes termitina O. S. 1882.
Libnotes familiaris O. S. 1882.
Mongoma tenera O. S. 1882.
Eriocera perennis O. S. 1882.
Eriocera mansueta O. S. 1882.
Tipula pedata Wied. 1821.
Pachyrrhina luconica O. S. 1882.
Pachyrrhina ortiva O. S. 1882.
Pselliophora suspirans O. S. 1882.
Pselliophora idalia O. S. 1882.
Pselliophora doleus O. S. 1882.
Scamboneura dotata O. S. 1882.

STRATIOMYIDÆ

Artemita azurea Gerst. 1857.
Ptilocera amethystina Vollen. 1857.
Ptilocera smaragdina Walk. 1849.
Tinda indica Walk. 1851 (*bispinosa* Thoms. 1869).
Rosapha bicolor Big. 1877.[6]
Negritomyia maculipennis Macq. 1849.
Musama ? paupera Walk. 1864.
Nemotelus albiventris Thoms. 1869.
Eulalia claripennis Thoms. 1869.
Eulalia ochropa Thoms. 1869.[7]
Microchrysa flaviventris Wied. 1824 (*annulipes* Thoms. 1869).

TABANIDÆ

Chrysops cincta Big. 1892.
Chrysops dispar Fabr. 1798.
Chrysops manilensis Schin. 1868.
Chrysops signifer Walk. 1861.
Chrysozona lunulata Macq. 1867.
? Diachlorus flavipennis Macq. 1850.
Tabanus ixion O. S. 1882.
Tabanus vanderwulpi O. S. 1882.
Tabanus striatus Fabr. 1794 (*manilensis* Schin. 1868).
Tabanus factiosus Walk. 1860.[8]

RHAGIONIDÆ

Atherix limbata O. S. 1882.
Chrysopilus ferruginosus Wied.
Chrysopilus correctus O. S.[9]

ASILIDÆ

Leptogaster princeps O. S. 1882.
Stichopogon peregrinus O. S. 1882.
Damalina cyanella O. S. 1882.
Damalina semperi O. S. 1882.
Damalis immeritus O. S. 1882.
Damalis vitripennis O. S. 1882.
Damalis nigellus Wulp. 1872.
Laphria dimidiata Macq. 1846.
Laphria partita Walk. 1857.
Laphria phalaris O. S. 1882.
Laphria pseudolus O. S. 1882.
Laphria scapularis Wied. 1828.
Promachus forcipatus Schin. 1868.
Promachus maculosus Macq. 1834.
Promachus manillensis Macq. 1838.
Promachus varipes Macq. 1838.
Philodicus integer Macq. 1846.
Philodicus longipes Schin. 1868.
Philodicus albispina Thoms. 1869.
Neoitamus ? longistylus Wied. 1828.
Ommatius chinensis Fabr. 1794.
Ommatius nanus Walk. 1851.
Ommatius retrahens Walk. 1859.[10]
Emphysomera aliena O. S. 1882.

[6] The species, *R. habilis* Walk. 1860, was given by Kertesz, *Cat. Dipt.* (1908), 3, 8, as from the Philippine Islands, but this error is corrected in *Ann. Mus. nation. Hung.* (1909), 379.

[7] Osten Sacken also records some unnamed species of *Geosargus* and *Ptecticus*.

[8] Osten Sacken also records 1 *Chrysozona* and 10 undetermined species of *Tabanus*.

[9] Osten Sacken mentions 3 undetermined species of *Chrysopilus*.

[10] Osten Sacken records also undetermined species of *Leptogaster*, *Damalis*, *Maira*, *Laphria* (7), *Promachus* (3), *Ommatius* (6), *Asilus* (12), and *Proctacanthus*. Macquart has erroneously recorded *Microstylum dux* Wied. and *Hoplistomerus serripes* Fabr.

BOMBYLIDÆ

Hyperalonia oenomaus Rond. 1875.
Hyperalonia flaviventris Dol. 1857.
Hyperalonia umbrifera Walk. 1849.
Anthrax distigma Wied. 1828.[11]

THEREVIDÆ

Psilocephala lateralis Esch. 1822.

EMPIDIDÆ

Elaphropeza exul O. S. 1882.[12]

DOLICHOPODIDÆ

Agonosoma vittatum Wied. 1819.
Agonosoma crinicorne Wied. 1874.
Diaphorus aeneus Dol. 1856.
Diaphorus maurus O. S. 1882.[13]

SYRPHIDÆ

Asarcina aegrota Fabr. 1805.
Asarcina consequens Walk. 1856.
Baccha pedicellata Dol. 1856.
Graptomyza literata O. S. 1882.
Graptomyza microdon O. S. 1882.
Eristalis agyrus Walk. 1849.
Eristalis babytace Walk. 1849.
Eristalis plistoanax Walk. 1849.
Megaspis errans Fabr. 1787.
Axona chalcopyga Wied. 1830.
Tubifera celeber O. S. 1882.
Milesia bigoti O. S. 1882.
Milesia ritsemae O. S. 1882.
Milesia semperi O. S. 1882.[14]

PHORIDÆ

Aphiochaeta banksi Brues 1909.
Aphiochaeta curtineura Brues 1909.[15]

TACHINIDÆ

Scopolia spinicosta Thoms. 1869.
Rutilia dubia Macq. 1843.
Sarcophaga frontalis Thoms. 1869.
Sarcophaga spininervis Thoms 1869.
Sarcophaga brevis Walk. 1864.
Sarcophaga sericeonitens Walk. 1861.
Rhynchomyia indica Rond. 1875.
Stomatorrhina muscina Rond. 1875.
Stomatorrhina lateralis Wulp. 1881.
Cosmina prolata Walk. 1860.
Phumosia abdominalis R. D. 1830.
Lucilia tagaliana Big. 1877.
Lucilia philippinensis Macq. 1843.
Lucilia fortunata Walk. 1860.
Lucilia ditissima Walk. 1861.
Chrysomya dux Esch. 1822.[16]

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[11] Osten Sacken records a *Hyperalonia* near *Tantalus* and an undetermined *Anthrax*.

[12] Osten Sacken has also a *Noeza* sp.

[13] Osten Sacken records an undetermined *Agonosoma* and a *Diaphorus*.

[14] Osten Sacken records some undetermined species of *Syrphus* (2), *Sphaerophoria, Baccha* (2), *Neosseia, Graptomyza, Eristalis* (3), *Tubifera*, and a *Milesia* near *conspicienda* Walk.

[15] Osten Sacken records an undetermined species of *Phora* and a species of *Dorylas* (*Pipunculus*).

[16] Osten Sacken records also some undetermined species of *Dexia, Prosena, Masicera, Miltogramma*, etc.

MUSCIDÆ

Musca conducens Walk. 1860.
Musca niveisquama Thoms. 1869.
Musca bivittata Thoms. 1869.
Musca favillacea Walk.
Anthomyia manillensis Frauenf. 1867.
Lispa grandis Thoms. 1869.[17]
Coenosia picicrus Thoms. 1869.

SCIOMYZIDÆ

Sepedon javanensis R. D. 1830.

CELYPHIDÆ

Celyphus obtectus Dalm.
Celyphus scutatus Wied. 1830.
Celyphus levis Wulp. 1881.

LAUXANIIDÆ

Lauxania latifrons Thoms. 1869.[18]

LONCHAEIDÆ

Lonchaea punctipennis Walk. 1860.

ORTALIDÆ

Scholastes cinctus Guér. 1830.
Lamprogaster placida Walk. 1849.
Notopsila sexpunctata O. S. 1882.
Notopsila curta O. S. 1882.
Rivellia fusca Thoms. 1869.
Pseudepicausta chalybea Dol. 1859.
Plagiostenopterina calcarata Macq. 1843.
Plagiostenopterina trivittata Walk. 1849.
Plagiostenopterina aenea Wied. 1823. (*abrupta* Thoms.).
Antineura stolata O. S. 1882.
Antineura sericata O. S. 1882.
Philocompus cupidus O. S. 1882.
Xenaspis polistes O. S. 1882.
Naupoda platessa O. S. 1882.[19]

TRYPANEIDÆ

Chaetodacus ferrugineus Fabr. 1794.
Chaetodacus icarus O. S. 1882.
Adrama determinata Walk. 1857.
Enicoptera proditrix O. S. 1882.
Gastrozona cassandra O. S. 1882.
Acanthoneura maculipennis Westw. 1848.
Acanthoneura alcestis O. S. 1882.
Ptilona brevicornis Wulp. 1880.
Rioxa lanceolata Walk. 1857.
Rioxa manto O. S. 1882.
Sphenisomyia sexmaculata Macq. 1843 (*melaleuca* Walk.).
Acidia fossata Fabr. 1805 (*elimia* Walk.).
"*Acinia*" *stellata* Macq. 1843.[20]

DIOPSIDÆ

Diopsis subnotata Westw. 1848.
Teleopsis belzebuth Big. 1874.
Teleopsis motatrix O. S. 1882.
Teleopsis selecta O. S. 1882.
Sphyracephala cothurnata Big. 1874.

[17] Osten Sacken mentions an undetermined species of *Lispa*.
[18] Osten Sacken records also 10 undetermined species of *Sapromyza*.
[19] Osten Sacken mentions an undetermined *Lamprogaster*.
[20] Osten Sacken records also a *Rioxa* and a *Tephritis*.

SEPSIDÆ

Sepsis revocans Walk 1860.
Sepsis linearis Walk. 1849.[21]

TYLIDÆ

Taeniaptera chrysopleura O. S. 1882.
Taeniaptera galbula O. S. 1882.
Taeniaptera nigripes Wulp. 1881.
Taeniaptera monedula O. S. 1882.
Taeniaptera coarctata Walk. 1861.
Trepidaria territa O. S. 1882.
Eurybata hexopla O. S. 1882.
Eurybata semilauta O. S. 1882.
Telostylus maccus O. S. 1882.
Gymnonerius duplicatus Wied. 1830.
Gymnonerius fuscus Wied. 1824.

PSILIDÆ

Chyliza selecta O. S. 1882.

CHLOROPIDÆ

Chlorops vittipennis Thoms. 1869.
Gaurax dimorphus O. S. 1887.

EPHYDRIDÆ

Dryxo digna O. S. 1882.
Dryxo spreta O. S. 1882.
Notiphila sternalis Thoms. 1869.
Discomyza obscurata Walk. 1860.
Ephydra pleuralis Thoms. 1869.[22]

DROSOPHILIDÆ

Drosophila ananassae Dol. 1859.
Drosophila hypocausta O. S. 1882.

GEOMYZIDÆ

Cyrtonotum arcuatum O. S. 1882.

HIPPOBOSCIDÆ

Ornithoctona nigricans Leach (*batchiana* Walk.).
Olfersia nigrita Speis. 1905.
Myiophthiria reduvioides Rond. 1878 (*capsoides* Rond.).[23]

Total, 283 species.

FIRST CENTURY OF THE BAKER COLLECTION

The types of the new species here described are to be found in the collection of Prof. C. F. Baker, and cotypes, so far as specimens were available, in my collection.

1. Evaza bipars Walk. 1857.

A rare species, previously known only from Borneo, New Guinea, and New South Wales.

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[21] Osten Sacken has 2 other species determined as *Sepsis testaceus* and *S. basifera*, by Walker.

[22] Osten Sacken records also a *Paralimna* sp.

[23] *Cyclopodia dubia* Westw., recorded by Walker, belongs to some other species.

2. **Ptilocera smaragdina** Walk. 1849.

I think that Osten Sacken's specimens are identical with these.

3. **Rosapha bicolor** Big. 1877.

An endemic and very characteristic species.

4. **Negritomyia maculipennis** Macq. 1849.

A common species, widely spread over the Malayan Archipelago and New Guinea.

5. **Microchrysa flaviventris** Wied. 1824.

Common throughout the whole Oriental Region, and found also in New Guinea.

6. **Solva flavipes** Dol. 1858.

Described from Amboina and recorded also from New Guinea. In our specimens the antennæ are yellow at the base, and the dark abdominal spots are almost fused together, forming a longitudinal stripe.

7. **Solva vittipes** nom. nov. (*vittata* Dol., 1858, not of Walker, 1837.)

Very distinct by the black longitudinal stripe on the underside of the hind femora. The abdomen is sometimes entirely black. The wings are wholly hyaline, not infuscated at the tip; the coxæ, however, are yellow, and the stripe of the femora is complete, differing therefore from the recently described *S. javana* Meij. of Java.

8. **Chrysops signifer** Walk. 1861.

Previously known from Batchian and Borneo.

9. **Tabanus rubidus** Wied. 1821.

Recorded from India, Java, and Sumatra. The single specimen examined shows the pattern of the abdomen as described by Schiner for his *T. manilensis;* but in regard to the form of the frontal callus, I think that Ricardo is right in considering the latter species as synonymous with the following.

10. **Tabanus striatus** Fabr. 1794.

Common over all the Oriental Region. Both sexes are represented in the collection, the males being the more numerous.

11. **Chrysopilus ferruginosus** Wied. 1879.

A common oriental species. Our specimens correspond very well with others formerly received from Formosa.

12. **Chrysopilus correctus** O. S. 1882.

A very distinct endemic species.

13. **Laphria dimidiata** Macq. 1846.

Widely spread over the Malayan Archipelago.

14. **Philodicus longipes** Schin. 1868.

An endemic species. I think it very probable that *Erax integer* Macq., 1846, is the same species.

15. **Ommatius chinensis** Fabr. 1794.

This is *O. fulvidus* of Osten Sacken's paper, a common species in the Oriental Region.

16. **Emphysomera aliena** O. S. 1882.

An endemic species.

17. **Systrophus sphecoides** Walk. 1860.

We have a single specimen which corresponds well enough with the description of this species. Previously known only from Celebes and Macassar.

Thorax entirely black, with a yellow vertical stripe from the humeri to the front coxæ which are black; metasternum distinctly bluish, with many transverse furrows. Front legs almost entirely yellow, only the femora brownish below, and the last tarsal joints dark.

18. **Agonosoma vittatum** Wied. 1819.

A beautiful species, widely spread over the Oriental Region.

19. **Paragus serratus** Fab. 1805.

Common in the Oriental (and also in the Ethiopian) Region, and also known from Formosa.

20. **Melanostoma planifacies** Macq. 1848.

A true *Melanostoma*, very distinct by the form of the face as described by de Meijere. Previously known only from Java. The previously unknown male has the abdomen entirely yellow, with very narrow black lines at the hind margins of the segments; genitalia of greater size, black, placed asymmetrically, the strong yellow penis prominent below. Legs entirely yellow.

21. **Asarcina ægrota** Fabr. 1805.

A common oriental species, known also from Formosa. Sack places it in the genus *Didea*, but it seems better to allow it to remain in the present genus, on account of the form of the oral opening, of the position of the ocelli, and of the presence of a very distinct thoracic collar. The species is wanting in the synopses given by me in my papers on the genus, but it is easily known from any other by the broad blackish band on the wings.

22. **Syrphus nectarinus** Wied. 1830.

This species is only an oriental variety of the common *S. balteatus* DeG.

23. **Baccha pulchrifrons** Aust. 1893.

A distinct species previously known only from Ceylon and Java.

24. **Baccha purpuricolor** Walk. 1859.

Seems to be a common species. Known before from Key Island and Mysol.

25. **Graptomyza brevirostris** Wied. 1820.

Formerly known from Java and the Nicobar Islands. A well differentiated species, new for the Philippines.

26. **Megaspis errans** Farb. 1787.

A common species in the Oriental Region.

27. **Syritta orientalis** Macq. 1842.

Formerly known only from India and Java.

28. **Eumerus flavicinctus** Meij.

Described from Java. Easily distinguished by the yellow scutellar margin. It seems to me very probable that *E. figurans* Walk. from Celebes is the same species.

29. **Eumerus bimaculatus** Dol. 1858.

A species described from Amboina, well distinguished by the coloration of the abdomen. The enigmatical *Citibaeus aurata* Walk. from Borneo seems to be an allied form.

30. **Prosena pectoralis** Walk.

Seems to be a common species. Formerly recorded only from New Guinea.

31. **Stilbomyia fulgida** Big. 1859.

A very fine species, originally from Celebes, and new to the Philippines. From Formosa I have received the allied *S. fuscipennis* Fabr.

32. **Lucilia fortunata** Walk. 1860.

Corresponds very well with the description of the type from Celebes, and is a true *Lucilia*.

33. **Pseudopyrellia lauta** Wied. 1830.

Described from Java and common in the Oriental Region.

34. **Stomoxys calcitrans** L. 1758.

A specimen from the Philippines is identical with others from Europe. Very common.

35. **Lispa pectinipes** Beck.

Our specimens agree with cotypes from Cairo in my collection. Formerly known from Egypt, Canary Islands, and Delagoa Bay. Stein has recorded it also from Java.

36. **Pygophora lobata** Stein. 1900.

Described from Singapore and New Guinea, and recorded from Java. Easily distinguished by the shape of the antennal arista and by the enormous male genitalia. The female is without doubt that described by Stein, and is very different from the male; there are specimens of both sexes in this collection.

37. **Sepedon plumbellus** Wied. 1830.

This is *S. javensis* of Osten Sacken's Enumeration, page 193, a species which, according to Hendel's paper, 1911, is widely spread in the Oriental Region and New Guinea.

38. **Sepedon violaceus** Hendel. 1909.

Described from Hongkong, recorded from Calcutta, and common in Formosa. The present specimens have the tip of the wings distinctly infuscated.

39. **Celyphus levis** Wulp. 1881.

This species has the arista dilated, and is certainly not a *Paracelyphus*. It seems to be variable in the coloring of the body and legs, from black to brownish yellow. The determination for the present is doubtful.

40. **Steganopsis bakeri** sp. nov.

Male.—Very near *S. pupicola* Meij. from Java, distinguished by the greater size, the front tarsi being entirely black, and the femora not being yellow at apex.

Length of body, 4 mm.; of antennæ, 1 mm.

A very distinct and interesting species, belonging, without any doubt, to this genus, erected in 1910 by de Meijere. The anterior fronto-orbital bristle is turned forward, as shown in his figure, and not backward as stated in the description.

Head entirely shining black; frons as broad as the eye, with a middle longitudinal furrow and some transverse furrows; face cylindrical, oblique, with very numerous but thin transverse furrows; prælabrum broad, prominent, shining black; proboscis and palpi black; antennæ very long, brownish yellow near the base, the third joint blackish, very much restricted after the insertion of the arista which is plumose. Thorax shining black, thickly punctulate, very short pilose; pleuræ whitish yellow; chest and sternopleuræ shining black, but the last with a narrow yellow streak on the upper margin. Bristles: 2 pairs of dorsocentral, 1 humeral, 1 præsutural, 2 notopleural, 3 supra-alar, 1 fine mesopleural, and 1 sternopleural. Scutellum black, flattened, punctulate as is the mesonotum, bare, with 4 strong bristles, the apical not crossed. Metanotum shining black. Halteres black. Abdomen flattened, entirely shining black, and very short blackhaired. Genitalia very small and black. Legs shining black; middle and hind tibiæ yellow with black tips; middle and hind tarsi yellow; front legs entirely black, the femora reddish beneath; front tarsi distinctly broadened. Wings brownish, almost black along the costal margin to the second vein; veins black, arranged as in *pupicola*.

41. **Pachycerina apicalis** sp. nov.

Male.—Very closely related to *P. javana* and *P. seychellensis* Lamb, 1912, but distinguished by the coloration of the wings, which have a brown costal margin and a narrow whitish apical lunule between the ends of second and fourth veins.

Length of body, 2.5 mm.; of antennæ, 0.8 mm. Frons opaque yellow, reddish toward the eyes, with a round opaque black spot on the ocelli, not prolonged forward; frontoörbital bristles inserted on brownish dots; face shining reddish, slightly convex, not prominent, with a round black shining spot on each side; prælabrum reddish; palpi black at the apex; antennæ yellow, the third joint very long, brownish black; arista short plumose, not feathered. Mesonotum shining reddish, almost bare; brown longitudinal stripes very indistinct; a broad yellowish streak extending from propleura along mesopleura to the hypopleura. Thoracic chætotaxy normal; 1 mesopleural and 1 sternopleural bristle. Scutellum, like mesonotum, with 4 bristles, the apical two parallel. Abdomen shining reddish, scarcely pilose; genitalia round, light yellow. Legs entirely yellow; front tarsi black, the first joint with yellow base. Wings with the second longitudinal vein, at the base, very divergent from the third, afterward passing near to the costa; third and fourth veins straight and almost parallel. Wings grayish; the costa brown from the end of the first vein to the end of the second, from whence it continues more diffused, to the hind margin of the wing, ending below the apex of the fourth vein. The whitish apical lunule is very distinct.

42. **Lauxania (Sapromyza) lucida** Meij. 1910.

Described from Java. An entirely shining yellow species with a black ocellar dot, and with the acrostichal bristles arranged in 6 series. The third antennal joint is darkened.

43. **Lauxania (Sapromyza) punctipennis** Meij. 1908.

Described from Java, and distinguished by the pattern of the wings, which is very like that figured by Lamb for his *S. striata.*

44. **Lauxania (Sapromyza) ornatipennis** Meij. 1910.

Formerly known only from Java, and easily distinguished by the coloration of the wings, antennæ, and legs. The allied *L. lunifera* Meij. has been found in Formosa.

45. **Trigonometopus albiseta** sp. nov.

Allied to *brevicornis* Meij. from Java, and exhibiting also 2 pairs of frontoörbital bristles (*T. monochæta* Hendel has only a single pair), but very distinct in the color pattern of wings and legs.

Female.—Length of body, 3.5 mm. Head grayish yellow; frons with a broad brown middle stripe; a black triangular spot between antenna and eye; a vertical brown stripe on each side of the face below; 2 horizontal stripes on the cheeks below the eyes, the superior being broader; antennæ light yellowish, the second joint darkened above, the third not pointed; arista whitish, rather long pubescent. Mesonotum and scutellum yellow, with 4 equidistant brown stripes on the back, the 2 middle ones prolonged on the scutellum; there is also a short brown notopleural stripe; mesopleura dark brown, toward the middle with a yellowish horizontal stripe; sternopleura brown, with the superior border yellow. There are 3 pairs of strong dorsocentral and 2 pair of præscutellar bristles. Halteres whitish. Abdomen yellow, each segment with a brown hind border, which is narrower in the male and broader in the female, the abdomen of the latter becoming almost all brown. Male genitalia rounded, yellow. Legs with the coxæ yellowish white; tibiæ with black apices; middle and hind femora outwardly with a broad oblique black band near the base; tarsi darkened. Wings whitish gray, last portion of the fourth longitudinal vein as long as twice the preceding and without stumps; costal cell hyaline; a brown fore border from the end of the auxiliary vein to the end of the second vein, reaching below to the second vein; a broad apical brown band, fused with the costal border and reaching the hind margin of the wing; a whitish apical lunule between ends of second and fourth veins; the 2 cross-veins have also broad dark margins, the dark margination of the hind cross-vein forming a preapical band.

46. **Trigonometopus bakeri** sp. nov.

Somewhat allied to the preceding species, showing also 2 pairs of orbital bristles, but well distinguished by the unicolorous yellow legs, long and thin brown arista, and different color pattern of head and wings.

Length of body, 5 mm. Head yellow; frons with a very narrow middle longitudinal brown stripe; a small black spot between antennæ and eyes; face retreating, wholly yellow, without black stripes, the lateral carinæ only being narrowly brown; cheeks with a short black stripe just below the eye. Antennæ short, wholly yellow, the third joint rounded at the apex; arista brown, very long, hair-like, short pubescent. Mesonotum and scutellum as in the preceding species, but with the brown stripes broader, the notopleurals being almost fused with the externals. Halteres with brown knob. Abdomen dark yellow, lighter at the base; segments with a black hind border which is broadened laterally; genitalia small, yellowish; venter pale, bristles black. Legs wholly whitish yellow, without any distinct dark marking; tarsi darkened at apices; front femora like the preceding, with 3 or 4 very long bristles beneath. Wings narrow and long; third and fourth veins parallel; cross-veins less approximate; distal portion of fourth vein once and a half as long as the preceding, without stumps. The brown of the costal margin fills up the costal cell, and, beginning at the base, is dilated to the fourth vein, after the hind cross-vein; there is no hyaline apical lunule; the cross-veins are very narrowly bordered with fuscous.

Genus LONCHAEA Fallén.

This collection includes very numerous species of this important genus, partly reared from different kinds of fruits by Professor Baker. None of these species are at all similar to any of those described by Kertesz, Meijere, or Lamb. I present here a table separating the species, remarking that all of them agree in the following characters: eyes bare; cheeks narrow; antennæ reaching the epistome; legs entirely black.

Key to species of Lonchaea.

*a*¹. Squamulæ brown, black behind.
  *b*¹. Scutellum on the sides with numerous short bristles; arista long plumose; abdomen black, very shining; length about 5 mm. citricola sp. nov.
  *b*². Scutellum having, besides the usual bristles, only a few short bristles near the apex; arista short plumose; abdomen brownish, less shining; length about 3 mm. ficiperda sp. nov.
*a*². Squamulæ white or light yellowish; white haired.
  *c*¹. Males.
    d.¹ Last abdominal segment twice as long as the preceding, deeply excavate in the middle, terminating in the form of two points, and being long pilose. excisa Kert.
    *d*². Last abdominal segment shorter, not excavated, and more or less pilose.
      *e*¹. Last abdominal segment less pilose; hypopygium small, with a prominent yellow penis. filifera sp. nov.
      *e*². Last abdominal segment long pilose; hypopygium more developed, but without prominent penis. setifera Meij.
  *c*². Females.
    *f*¹. Arista rather long plumose as usual; scutellum with some bristly hairs on the sides and at the apex.
      *g*¹. Scutellum not pollinose, shining black; abdomen brownish; wings hyaline; ovipositor exserted. ficiperda sp. nov.
      *g*². Scutellum grayish pollinose; abdomen shining black; ovipositor retracted. filifera sp. nov.
    *f*². Arista very short plumose; scutellum aeneous, not pollinose, with the usual 4 bristles and only a pair of shorter bristly hairs between basal and apical bristles. calva sp. nov.

47. Lonchaea citricola sp. nov.

A shining black species, distinguished by the black squamulæ and very bristly scutellum, and by its greater size. It was reared from *Citrus* fruits, together with *Monacrostichus citricola* sp. nov. It seems to be allied to *L. biroi* Kert. and *L. obscuripennis* Meij.

Male.—Length of body, 4.5 to 5 mm. Frons opaque velvety black, one-fifth as broad as of the head; face gray pollinose; arista black, yellowish at the base, rather long plumose; third antennal joint broad; lunule black; palpi black and bristly. Mesonotum and scutellum not pollinose, the latter with very numerous bristly hairs on the sides, at least 14 or 15 pairs, 2 or 3 of which are apical. Last abdominal segment short and not specially pilose; hypopygium very small, with the penis not prominent. Wings grayish hyaline, with yellowish veins.

48. **Lonchaea ficiperda** sp. nov.

A small, brownish, less shining species, distinguished by the different coloring of the squamulæ in both sexes. Reared from maggots in fruits of *Ficus megacarpa* Merrill.

Male and female.—Length of body, 3 to 3.2 mm.; of the exerted ovipositor, 1.3 mm. Face and frons as in *L. citricola*, the frons of the female twice as broad as that of the male. Third antennal joint narrow; arista black, shorter plumose. Scutellum not pollinose, with 3 or 4 pairs of lateral bristly hairs, 2 or 3 on the sides and 1 on the apex. Halteres black. Abdomen of the male with the last segment short and not especially pilose; hypopygium small, with penis not distinct. Wings hyaline.

49. **Lonchaea excisa** Kertesz, 1901.

A shining black species, well distinguished by the shape and pilosity of the last abdominal segment of the male, as figured by Meijere. *L. plumata* Lamb, 1912, from the Seychelles seems to be a very closely allied species, if not the same. The pollinose scutellum bears 3 or 4 pairs of small bristles, 1 pair being apical.

50. **Lonchaea filifera** sp. nov.

A shining black species, with white squamulæ in both sexes, distinguished by the prominent yellow penis of the male.

Male and female.—Length of body, 3.5 mm. Frons of male rather broad, one-fourth of the width of the head, somewhat shining sericeous; antennæ slightly brownish at the base, the third joint gray, arista rather long pilose. Mesonotum posteriorly and scutellum pollinose, the latter with 3 or 4 pairs of small bristles, 1 pair being apical. Last abdominal segment of male once and a half the length of the preceding, not setose; hypopygium very small; penis prominent, in the shape of a thin pale yellow hair, longer than the usually black surrounding hairs; of the female ovipositor only the point is visible. Wings hyaline or slightly infuscated.

51. **Lonchaea setifera** Meijere, 1910.

A shining black species, closely allied to the preceding, but distinct by the last abdominal segment, as figured by Meijere. Scutellum the same as in the preceding.

52. **Lonchaea calva** sp. nov.

Shining æneous on mesonotum and scutellum, black on the abdomen. Very distinct from any other species in the short pilose arista and the bare scutellum.

Female.—Length of body, 3 mm.; of ovipositor, 1 mm. Frons as broad as one-fourth the width of the head; arista black, very short pilose. Scutellum small, with only a pair of lateral small bristly hairs. Halteres black. Ovipositor exserted. Wings hyaline.

53. **Plagiostenopterina ænea** Wied. 1830.

A common species in the Oriental Region. Known also from Formosa.

54. **Plagiostenopterina calcarata** Macq. 1843.

Well distinguished by its beautiful shining blue coloring and by the strong trochanteral spine of the male.

55. **Plagiostenopterina trivittata** Walk. 1869.

Distinguished by the color pattern of the thorax; the same as *P. zonalis* Rondani, from Borneo. Walker placed it originally in *Dacus*.

56. **Elassogaster sepsoides** Walk. 1861.

Described from Amboina and Batchian, and as *E. unimaculatus* Kert. from New Guinea. Found also in Formosa. Its similarity to *Sepsis viduata* Thoms. is very striking.

57. **Rivellia basilaris** Wied. 1830.

Described originally from Sumatra, and recently recorded from Formosa.

58. **Rivellia fusca** Thoms. 1869.

An endemic species.

59. **Gorgopsis cristiventris** Gerst. 1860.

A very peculiar species, described originally from Amboina.

60. **Naupoda platessa** O. S. 1882.

A very interesting endemic species.

61. **Chrysomyza ænea** Fabr. 1794.

A common species in the Orient. Known also from Formosa.

62. **Chætodacus caudatus** Fabr. 1805.

Common in the Oriental Region. A specimen in this collection agrees with the description of the var. *nubilus* Hendel, from Formosa, having the posterior cross-vein only shaded below, but it has the brown spot at the apex of the femur.

63. **Chætodacus cucurbitæ** Coq. 1899.

The present material agrees with my specimens from India. The allied *synnephes* Hendel, from Formosa, has four scutellar bristles.

64. **Chætodacus ferrugineus** Fabr. var. **pedestris** nov.

Mesonotum, pleuræ, and metanotum intensely black, with the typical yellow streaks and spots; the brown spots on the frons very well marked, including a central large round dot. Tibiæ dark brown, the posterior ones black; all the femora with a broad black ring before the apex most strongly developed on the fore pair, on the middle and hind pairs distinct at least on the underside. Costal border of the wings broader and darker.

Length of body, 6 to 8 mm.

This form of the variable species is closely allied to *C. dorsalis* Hendel from Formosa (which may be a form of *C. ferrugineus*), but is at once distinguished by the color of the legs. The typical Indian form has the legs more yellow; var. *obscuratus* Meij. has no yellow lateral stripes on the dorsum; *C. cilifer* Hendel has the yellow lines, but shows a wholly black abdomen.

Genus **MONACROSTICHUS** novum

According to my paper on Indian trypaneids, true species of *Dacus* are wanting in the Oriental Region, where are to be found only species of *Bactrocera* and *Chaetodacus*. Professor Baker has, however, sent to me what is in certain characters a true *Dacus*, but it has no anterior supra-alar and no præscutellar bristles. This form shows, however, so many other unique peculiarities, that I think it better to erect for it a new genus, the type of which might perhaps be considered *Dacus longicornis* of Wiedemann (not of Guérin-Méneville which is a *Bactrocera*), although it is certainly well represented by the new species *M. citricola*. It may be characterized as follows:

Like *Chætodacus*, but without anterior supra-alar and præscutellar bristles; antennæ very long and geniculate; abdomen conspicuously constricted about the base, club-shaped as in *Conops;* front femora with some spines beneath near the apex; second abscissa of the fourth longitudinal vein very sinuose before the small cross-vein, the discoidal cell being therefore very distinctly narrowed near the base.

A particular feature of this genus (or at least of the species described below), and which I have never before noted in any trypaneid known to me, is the presence of a single but rather strong, acrostichal bristle placed on the middle line before the suture, and therefore not paired. Of 5 specimens examined, 3 do not have this peculiar bristle, 1 has it on the suture, and 1 before the suture.

The type of the genus is *Monacrostichus citricola* sp. nov.

The genera of true Dacinæ known from the Oriental Region can be distinguished as follows:

Key to the genera of Dacinæ of the Oriental Region.

a^1. Femora not spinose beneath; anterior scutellar and præscutellar bristles present.
  b^1. Wings banded.......... Bactrocera G.-M.
  b^2. Wings not banded.......... Chætodacus Bezzi.
a^2. Femora spinose, at least those of the first pair.
  c^1. Anal cell drawn out in a long point; second basal cell dilated; arista bare; abdomen club-shaped.
    d^1. The first 2 joints of the antennæ united in a single joint, forming a unique peduncle.......... Callantra Walk.
    d^2. The first 2 joints of the antennæ wholly separated. Monacrostichus gen. nov.
  c^2. Point of the anal cell very short; second basal cell not dilated; arista short plumose; abdomen cylindrical; all the femora spinose.
    e^1. Antennæ much longer than the face.......... Meracanthomyia Hendel.
    e^2. Antennæ shorter than the face.......... Adrama Walk.

Key to the presumptive species of Monacrostichus.

a^1. Wings cinereous, tawny along the costa and along the veins, blackish toward the apex; face with a broad triangular black spot in the middle; mesonotum tawny with a black dot on each side of the fore border; length "8 lines;" (Waigoe.) (This species is perhaps a *Xenaspis*).......... sepedonoides Walk.
a^2 Wings grayish hyaline, with a brown streak along the costal border; length 8–9 mm.
  b^1. Dark costal margin of wings extending to the fourth vein; anal cell with a brown streak; face with an elongated black mark on each side; femora broadly blackish brown. (Gosford, N. S. W.). aequalis Coq.
  b^2. Brown costal border not reaching the fourth vein; anal streak wanting.
    c^1. Face with a black oral border; brown border of wings passing the third vein; femora yellowish or blackish.
      d^1. Palpi yellow; face with a black dot on each side; yellow spot on sternopleura small; femora yellowish (Java). longicornis Wied. (*vespoides* D.)
      d^2. Palpi black; face broadly black below; spot on sternopleura broad; femora blackish, somewhat yellow at both ends (Java). conopsoides Meij.
    c^2. Face in the middle with a transverse black band united with the black antennal cavities; this band is dilated below toward the middle and prolonged to the mouth; dark yellowish costal area of wings hardly passing the third vein; femora yellow, with a broad black streak below; palpi yellow.......... citricola sp. nov.

65. Monacrostichus citricola sp. nov.

A very distinct waspish-looking fly, which seems to be allied to *longicornis*, but is easily distinguished from that and its allies by the peculiar color pattern of the face. Professor Baker has reared this from *Citrus* fruit, at Los Baños, P. I., together with *Lonchaea citricola* sp. nov.

Male and female.—Length of body, 9–10 mm.; of wing, 8–9 mm.; of the antennæ, 3 mm.; of the ovipositor, 1.5–3 mm. Head as described by Meijere for his *conopsoides;* frons without lateral spots, but with a large rounded middle spot; the peculiar black middle band of the face with the yellow portion over it prominent in the form of a broad tubercle; the palpi are sometimes infuscated, brownish; third antennal joint black; arista dark reddish; there is only the basal pair of frontoörbital bristles. Mesonotum blackish brown, with 2 approximate broad longitudinal gray bands; the median triangular yellow spot behind the suture is well developed; pleural yellow stripe ending on the middle of the sternopleura; metanotum black, yellow laterally, this yellow uniting with the yellow hypopleural spot. Scutellum yellow, narrowly black at the base, with a pair of weak apical bristles. Pteropleural bristle distinct, but not very strong. First abdominal segment black; second black with a narrow yellow hind border, and a broad yellow median band interrupted centrally by a black line; other segments reddish yellow, with golden pubescence, and a broad black band on anterior half; third segment of the male not ciliated; ovipositor short, flattened, reddish with brownish base. Legs yellowish red, all the femora below with a broad black longitudinal band; hind tibiæ brown; first joint of all the tarsi whitish. Front femora with 3 or 4 black spines near the apex. The dark yellowish costal area of wings extends caudad to fourth vein as far as the origin of basal cross-vein, after which it extends little caudad of the third; anal cell hyaline, its point very long and acute, the stump of the sixth vein very short.

66. **Enicoptera proditrix** O. S., 1882.

A very fine species, which on account of its complete chætotaxy cannot be placed among the Dacinæ, which it resembles only in the want of the sternopleural bristles. Enderlein has recently recorded this species from Sumatra.

67. **Gastrozona capillata** sp. nov.

This and the following species can be placed in my genus *Gastrozona* on account of the form of the antennæ, want of ocellar bristles, and color pattern of the wings; but they differ from the typical species in having very numerous (6 or 7) lower frontoörbital bristles.

Female.—Length of body, 6 mm.; of ovipositor, 1.5 mm.

Head whitish; frons yellow; a black spot on the middle of the occiput; all the bristles black, the genal bristles rather strong; no distinct ocellar bristles; the 6 pairs of lower frontoörbitals are bent inward; antennæ yellow, not reaching the epistome, the third joint rounded at the apex; arista long but thinly plumose; palpi yellow, short pilose, very much dilated. Mesonotum shining black; the humeri and a broad oblique band crossing the metapleura and reaching the pteropleura are whitish; hypopleura and sides of metanotum also whitish; chætotaxy complete, nearly all the bristles black, only the 2 or 3 mesopleural ones yellow. Scutellum wholly white, with 4 black bristles and some yellow hairs on the middle. Squamulæ grayish; halteres whitish. Abdomen shining black, with black pile and bristles at end; first segment yellow with yellow pile; a quadrate yellow spot toward the middle of the penultimate segment; ovipositor flattened, shining black. Venter yellow. Legs with coxæ and tarsi entirely pale yellow; all the bristles yellow; middle tibiæ with a single black spur; row of hairs on the hind tibiæ short but strong. Wings with the third vein bristly to the end; small cross-vein a little before the middle of the discal cell. Wing pattern brown, very similar to those of Plate VIII, figs. 17 and 18, of my paper on Indian trypaneids; but the brown costal area is entire, not interrupted after the stigma, which is wholly black, showing only a small hyaline spot before the base and another beyond the apex; the subapical cross band is united with the costal band; the band on the hind cross-vein is prolonged obliquely to the anal vein, forming a band almost parallel to the hind margin.

68. **Gastrozona luteiseta** sp. nov.

A yellow species with black and white markings, allied to the preceding, but distinguished by a different wing pattern, and entirely yellow bristles, only the dorsocentrals being black.

Male.—Length of body, 6 mm. Head and its appendages as in the preceding, but all of the bristles, including those of the occipital row, yellow; no ocellar bristles. Mesonotum yellow with yellow pile; the white pleural markings as in the preceding species; a spot over the humeri and the hind border of the back along the base of the scutellum, black; a spot on the hypopleura and metanotum black; chætotaxy normal, the bristles yellow, only the two dorsocentrals black. Scutellum whitish, yellow on the sides above, with 4 yellow bristles, and numerous and long yellow hairs on the middle. Squamulæ and halteres white. Abdomen wholly yellow, shining; there are on the middle 2 parallel, longitudinal black stripes, from the second to the fourth segment; sides of last segment black beneath; genitalia yellow; hairs yellow, but some black bristles on last segment. Legs entirely as in the preceding. Wings with a similar pattern, but the costal area is yellow, not brown, and distinct from the costa, the costal cell with the stigma being hyaline; the gray band on the hind cross-vein is isolated and narrow; there is a small gray spot toward the middle of the anal vein; the apical and subapical bands are gray, not brown.

69. **Acanthoneura maculipennis** Westw.

This characteristic and not rare species is represented by a male.

70. **Ptilona brevicornis** Wulp.

Our specimens represent the typical form, very distinct by reason of its reduced chætotaxy. I have seen it also from Formosa.

71. **Rioxa caeca** sp. nov.

Very near the female of *lanceolata* (as described by Enderlein), but distinguished by the want of the apical hyaline spot of the wings.

Female.—Length of body, 9 mm.; of ovipositor, 2.5 mm. Head with its appendages yellow; all the bristles black; orbital bristles 2 and 3, the first very small. Mesonotum and pleuræ light yellow, dark brownish on the back but without distinct color pattern; chætotaxy complete. The middle pair of lateral bristles on the scutellum only a little weaker than the others. Halteres yellow with brownish knob. Abdomen shining black, the basal yellowish middle stripe very narrow, less distinct, not surpassing the third segment. Legs with the tarsi entirely pale yellowish. Wings with the characteristic black foremargin of *R. lanceolata*, without any hyaline spot on the stigma and without any hyaline indentation; there are only 2 very small hyaline discal dots, one near the base of the first posterior cell, the other near the apex of the discal cell; 2 larger dots are to be seen in the second posterior cell at the hind margin; a dot on the apex of the third posterior cell, which is hyaline in its greater part as is also the axillary cell. There is also a yellowish, less distinct, spot just over the small cross-vein; the hyaline apical spot between the ends of third and fourth veins is wholly wanting. The second longitudinal vein is a little wavy, but not so much so as in *Acanthoneura*.

Genus SPILOCOSMIA novum

It is necessary to erect this new genus for a species in this collection which shows a striking coloring of the body, combined with a pointed third antennal joint, and want of ocellar bristles. Head broad; eyes rounded; third antennal joint not reaching the epistome, and with its external angle very pointed; arista plumose; orbital bristles, 2.2 mm.; occipital row with thin, black bristles; genal bristle strong. Palpi rather narrow, bristly. Thoracic chætotaxy complete; a very strong pteropleural; 2 mesopleurals. Scutellum with 4 bristles. Abdomen bristly at the end. Front femora with a row of bristles beneath; middle tibiæ with 2 spurs; hind tibiæ with a row of strong hairs. Wings broad, with a strong costal bristle; stigma short; second vein straight; third vein bristly over its whole length; a small cross vein after the middle of the discal cell; anal cell drawn out in a long point. Body yellow with black spots. Wings with yellow and brown cross bands, without basal streaks.

Type: *Spilocosmia bakeri* sp. nov.

This genus seems to be allied to the Bornean *Chelyophora* Rondani.

72. Spilocosmia bakeri sp. nov.

A yellow species, with 12 black spots on the body and with 1 yellow and 2 brown bands on the wings.

Male.—Length of body, 8 mm. Head pale yellow; frons darkened in the middle above the antennæ; there is also a very small black ocellar dot; a rounded black spot occurs on the face toward the middle of the epistome; antennæ yellow; palpi yellow, with black bristles. Mesonotum and scutellum entirely shining yellow; the rounded black spots are as follows: One on the humeral callus, 1 on each side of the median dorsal suture, at the second notopleural bristle, 1 at the inner supra-alar bristle (the largest of all), and 1 on the end of the scutellum. All the bristles are black. Squamulæ and halteres yellow. Abdomen elongate, entirely shining yellow, black pilose; last segment with a black spot on each side. Genitalia black. Venter yellow, with a marginal black line from second to fifth segment. Legs entirely yellow, black setose. Wings with yellow veins; stigma yellow; from it arises a yellow band which passes over the basal cross-veins to the anal cell; the 3 brown bands are narrow; the first band begins near the middle of the costa between the ends of the first and second veins, and passes obliquely over the small cross-vein to the hind margin, reaching it at the end of the anal vein; the second begins a little before the end of the second vein, and, passing over the hind cross-vein, ends (where it is dilated) at the hind margin near the middle of the third posterior cell; the third band has the shape of an apical arch, which extends from the end of the second vein to the end of the fifth; this last band is broader than the others, but is interrupted toward the middle by an oblique hyaline streak, which ends at the apex of the fourth vein.

73. **Sphenisconmyia sexmaculata** Macq. 1843.

A widely spread species, the distribution of which is from South Africa to the Philippines and Formosa.

74. **Rhabdochaeta bakeri** sp. nov.

Nearly allied to the type species of the genus (*R. pulchella* Meij. from Java), but distinguished by the scutellar bristles and wing pattern.

Male and female.—Length of body, 2.5 mm. Head and its appendages as in *R. pulchella;* third antennal joint very decidedly pointed; palpi feathered; frontoörbital bristle dilated. Thorax as in *R. pulchella;* scutellum with 6 dorsal bristles; there is a pair of smaller white bristles before the basal pair, which are longer and darker; the apical pair is crossed, and under this is to be seen another pair of smaller bristles, which are also crossed. Ovipositor short and truncate, and of a shining reddish color. Middle and hind femora with a single dark ring (the apical), which is mostly indistinct. Pattern of wings very much like that of *R. pulchella,* but around the blackish spot placed just above the hind cross-vein there are 3 reddish brown spots disposed in a triangle; the largest spot is in the discal cell, just below the small cross-vein. The coloring of the spots is very much like that of the similar spots in *Schistopterum moebii* Beck.

75. **Oxyna parca** Bezzi. 1912.

The present specimens are identical with those from India.

76. **Oxyna sororcula** Wied. 1830.

Agrees with my Canarian specimens.

77. **Trypanea amoena** Frauenf. var.

Some of our specimens agree with those from India, but differ in the want of the superior part of the brown streak issuing from the stigma and in the lack of the brown spot on the fifth vein.

78. **Diopsis subnotata** Westw. 1848.

A characteristic species, very distinct by its great size.

79. **Teleopsis belzebuth** Big. 1874.

The specimens from Formosa, referred to this common Philippine species by Hendel, seem to belong to some other species.

80. **Sepsis viduata** Thoms. 1869.

A very distinct dark species, previously known only from China.

81. **Sepsis spectabilis** Meij. 1906.

Previously known from Singapore and New Guinea.

82. **Taeniaptera galbula** O. S. 1882.

This fine Philippine species has recently been found also in Formosa.

83. **Eurybata semilauta** O. S. 1882.

An endemic species, very distinct in the peculiar wing pattern.

84. **Telostylus maccus** O. S. 1882.

The present specimens differ from the type by the want of the black spots on sternopleura and on hypopleura; the propleural spot is, on the contrary, very broad. This variability shows, perhaps, that *T. maccus* is only a form of the typical species *T. binotatus* Bigot; the allied *T. decemnotatus* Hendel from Formosa is possibly, also, only an extreme form.

85. **Telostylus niger** sp. nov.

Very near *T. maccus* in all plastic characters, but distinguished by the general black coloring, by reason of which it seems to be allied to the recently described neotropical *T. vittatus* Cressen.[24]

Female.—Length of body, 5.5 mm.; of antennæ, 2 mm.; of ovipositor, 1.3 mm. Head black; frons velvety black with a red spot above the antennæ; face red, with a velvety black spot on the cheeks; a pair of orbital bristles, 2 pairs of verticals, and a pair of crossed postverticals; antennæ red, the third joint a little infuscated near the tip; arista longer than remainder of the antennæ, white and short white pilose. Thorax brownish black on the dorsum, shining black on the pleuræ; on each side of the suture there is a dark reddish triangular spot, and above the root of the wings a broad velvety black one. Scutellum black, with 4 bristles, the basal pair very small. Halteres pale yellow. Abdomen shining black, short black haired; ovipositor with red tip. Legs reddish yellow, hind coxæ, tarsi, and fore tibiæ black; femora with a narrow black ring on the last third;

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[24] *Ent. News* (1912), 23, 390.

middle and hind tibiæ darkened. Wings as in *T. maccus*, but the apical third infuscated; there is also an infuscation on the fourth vein between the cross-veins.

86. **Gymnonerius fuscus** Wied. 1824.

Known also from Formosa through Hendel.

87. **Megamerina annulifera** Big. 1886.

A very distinct species, originally described from Celebes, and well placed in this genus by its author. The frons bears a distinct frontoörbital bristle.

88. **Gobrya bacchoides** Walk. 1860.

I think that Walker is in error in describing the arista of this species as pubescent; in the specimens before me it is very clearly plumose as described and figured by Meijere for his Javan *G. simulans.* This last, however, has a shining black abdomen, while in *G. bacchoides* there are 2 yellow bands, 1 narrower at the end of the second segment and 1 broader at the end of the third. The position of this strange insect among the Tylinæ is very doubtful; it has also but a superficial likeness to the Psilinæ; it is probably better to place it in a special subfamily Megamerininæ with some other genera, such as *Toxara, Syringogaster,* and *Syrittomyia.*

89. **Chyliza elegans** Hendel. 1913.

We have a female specimen of this species which was only recently described from Formosa. It differs from *C. selecta* in having the 2 basal joints of antennæ deep black, the legs entirely yellow, and the frons black toward the middle.

90. **Metopostigma sauteri** Beck. 1911.

This species is described as being common in Formosa. Our specimens agree very well with the description, but the frons shows in its anterior part an oblique brown spot on each side, of which Becker says nothing.

91. **Chlorops ochracea** Beck. 1911.

Originally described from Java, and easily distinguished by the black antennæ and the wholly yellow pleuræ and legs.

92. **Chromatopterum elegans** sp. nov.

This pretty species seems to be more nearly allied to the Ethiopian *C. delicatum* than to the Australian *C. pubescens.*

Female.—Length of body, 2.5 mm. Head whitish yellow; occiput entirely shining black; frontal triangle of greater size, shining black and smooth, convex, reaching the base of the antennæ, where it is rounded and not pointed, and allows only a narrow streak of the yellow color on each side; antennæ short, dark yellow, the third joint almost rounded and brownish; arista brown, microscopically pubescent. Thorax shining black, but there are on the mesonotum before the suture 2 pale yellow parallel streaks, which thus give it the appearance of having 3 united black stripes; pleuræ shining brown, with a broad whitish stripe in the notopleural region, which reaches the middle of the mesopleura. Scutellum shining black, pale yellow toward the middle above; 2 very strong apical bristles. Halteres pure white. Abdomen shining black, pale yellow on the venter. Legs with the coxæ yellow; last tarsal joint blackish; hind femora darkened on the last half. Wings as figured by Becker [25] but the black fore border not surpassing the second vein at the base; apical brown spot surpassing the third vein and reaching the middle between the end of the third and fourth veins.

93. **Gaurax nigricornis** Beck. 1911.

Our specimens agree very well with the description in the coloring of the antennæ, legs, and wings; but the scutellum is entirely black above, being also as coarsely punctate as the mesonotum, and only below reddish or yellowish; the brown fore border of the wings covers almost all of the third vein.

94. **Gaurax dimorphus** O. S. 1882.

A female specimen is before me which I take to be the female of Osten Sacken's male, while the female of Osten Sacken's species belongs probably to some other species. This was not known to Becker. From Osten Sacken's description of the male there are the following differences: the basal joints of antennæ are black; the face and palpi are black; the first abdominal segment and the middle of the second are pale yellow; all the coxæ are yellow; middle femora narrowly black near the base; hind tibiæ broadly black toward the middle; hind femora wholly yellow.

95. **Pseudeurina maculata** Meij. 1904.

A very distinct species previously known only from Java.

96. **Notiphila sternalis** Thoms. 1869.

An endemic species and a true *Notiphila*.

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[25] *Ann. Mus. nat. Hung.* (1910), Pl. 13, fig. 10.

97. **Paralimna nitens** sp. nov.

Near *P. javana* Wulp., but distinguished by the color of the head and of the thorax; *P. chinensis* Wied. seems to be another allied species, while *P. sinensis* Schiner is very different.

Male and female.—Length of body, 3.5 mm. Head black, shining on the occiput; face, cheeks, and prælabrum light gray; frons dull, shining along a middle broad longitudinal stripe, with 2 small white dots on each side near the eyes, velvety black in front; cheeks velvety black above, with a white spot; antennæ short, black, the second joint with a white spot above; arista with 9 or 10 rays; palpi and proboscis black. Thorax on the pleuræ of as light a gray color as that of the face, shining black on the dorsum, dark gray on the sides and along the suture. Scutellum gray on the basal half, dull black on the apical. Halteres yellowish. Abdomen dull black and black pilose; second segment almost entirely whitish gray; third, fourth, and fifth with a broad apical band of the same color, which is broadly interrupted in the middle. Legs black, gray pollinose, the first joint of the front tarsi and the first 2 joints of the others are yellow. Wings grayish hyaline, with yellowish veins.

98. **Discomyza maculipennis** Wied. 1830.

Widely spread over the Australian and Oriental Regions. *D. obscurata* Walk. is very probably the same species.

99. **Ochthera innotata** Walk. 1860.

Our specimens agree with this species in the entirely black legs. Originally described from Macassar and Ceram. The front is shining black, showing only a narrow yellowish streak on each side near the eye. Antennæ very short; arista with 3 rays. Thorax and scutellum coarsely punctate, with bluish reflections toward the middle. Abdomen with grayish spots on the sides of the segments, only those of the last segment being visible from above and forming an interrupted cross band. Middle tarsi sometimes yellowish. Scutellum with 2 distinct but small apical tubercles; no apical bristles (perhaps broken in these specimens).

100. **Chalcidomyia apicalis** Meij. 1911.

This Javanese species is very distinct. The antennæ, which were broken in the specimen described by Meijere, are, in our specimens, of the same shape as in the other species. The sternopleura has no yellow spot on the upper hind corner.